The

Electrical Review

VOL. XCV. SEPTEMBER 26, 1924. No. 2,444

THE OLDEST ELECTRICAL PAPER. ESTABLISHED 1872.

Published every FRIDAY, Price 6d.

Chairman: H. ALABASTER.

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Telegraphic Address: "AGEKRAY, CENT., LONDON," Code, A B C. Telephone Nos.: Central 8260 and 8261.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES, Postage Free: United Kingdom, £1 14s. 8d.; Canada, £1 12s. 6d.; Colonial and Foreign, £2 1s. 6d. per annum. Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, LIMITED, and crossed "Midland Bank, Newgate Street Branch."

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Public Office and Private Interests.

THE late Mr. Justice Bailhache's decision in the case of Lapish *v.* Braithwaite continues to excite a good deal of comment, and not a few municipal councillors in different parts of the country are withholding their public service until the promised appeal has been heard.

All the letters in the Press that we have read during the past month, and all the withdrawals of service that have been reported, have failed to alter the view briefly expressed in this journal on August 22nd under the title "Municipal Administration and Private Interests."

Admitting that men who have succeeded in private industry and trade are essential for the efficient administration of the great business affairs of municipal corporations and councils, it is of the utmost importance that the conduct of public affairs shall be on the highest possible level and that there shall be no suspicion possible of the exploitation of public interests for private ends. If the men now in authority cannot "carry on" in the interests of the ratepayers without its being continually held up against them as a reproach that they are or may possibly be parties to the placing of public contracts with themselves, or with others with whom they act in association, the right and proper thing for them to do is to withdraw. But is there not a way out of the difficulty which will satisfy the mind of the community without depriving it of the services of public-spirited and experienced men whose only disqualification is that they have business interests? It is by no means an uncommon thing for men to decline to express an opinion in public meeting regarding, and to refuse to vote upon, a particular subject because they are personally interested in it.

The knowledge that councillors have sometimes "found" that their local trade was in a more prosperous condition while they held a seat on a local council; that councillors' relatives or friends have sometimes secured employment in their local public utility undertakings; and that, speaking generally, public posi-

tion sometimes brings personal advantage to the one who holds it, and to his friends, emphasises the necessity for the strictest principles to be followed, but there is no wisdom in setting up an unreasonable standard which ignores the difficulties of its application.

Cabinet Ministers who happen to be drawn from the business world and are required by recognised custom to resign from the directorates of companies in order that they may worthily hold the highest office, often enough retire only temporarily and, may be, even as a matter of form, if we may judge from the fact that they return to their former positions when they leave a Ministry. But municipal life is going to be absolutely closed to many of our leading men of business experience if they are to be required to relinquish, even temporarily, connection with the businesses that they have built up. The course that may be open to a highly paid and highly honoured Cabinet Minister is not open to the average municipal councillor. What, then, is the way out? The answer is the most obvious one already indicated—let the councillor refrain from taking part in discussion on or voting upon any matter that may arise affecting contract relations with himself and the concerns with which he is definitely identified. This, be it noted, is what is required of a councillor under Section 46 of the Local Government Act of 1894.

By far the most important contribution to the subject that has met our eye is the letter appearing in *The Times* of September 18th from the pen of Sir Reginald Blair, chairman of the London Municipal Society and National Union of Ratepayers' Associations. Sir Reginald remarks that there is a good deal of misapprehension prevalent respecting the Bailhache decision. The judge in that case based his decision on Section 12 of the Municipal Corporations Act of 1882, which governs municipal corporations and county councils. Sir Reginald points out that other classes of local authorities (metropolitan boroughs, district councils, and boards of guardians) are governed by Section 46 of the Local Government Act, 1894. The wording in the two Acts mentioned is entirely different, and counsel's opinion is to the effect that, in order to prevent the conflict between interest and duty, Section 46 of the Local Government Act, 1894, lays it down that a shareholder in a company is not disqualified for being a member of a council or board of guardians because his company has a bargain or contract with the council; but the section provides that the shareholder *must not vote* on any question in which such company is interested.

No doubt later on steps will be taken to bring about uniformity in the two Acts in regard to the principle to be imposed.

We welcome the excitement that the Bailhache decision has stirred up, because it will operate to keep the public conscience sensitive in respect of a matter concerning which we are in danger of becoming indifferent unless some local scandal of the first importance or some ruling of a Court of Law arises to keep it well in mind.

Research in Technical Literature.

THE enormous advantages derived from scientific research have often been emphasised in our pages; but there is one aspect of it which may be worth further comment. A vast amount of research has been carried on in past years purely for love of the work, and doubtless numerous observations have been put on record in the literature of science which, if unearthed in the light of present-day knowledge and needs, would be of inestimable value. Many instances may readily be called to mind where discoveries of this kind have been turned to most effective use. An outstanding example is the research carried on by a monk named Mendel, on the transmission of characteristics by the cross-breeding of plants; buried for centuries in an obscure publication, his observations were disinterred some years ago and threw a flood of light on the principles of heredity. Another is the "Edison effect," observed in the infancy of the incandescent lamp, and resulting years afterwards in the invention of the Fleming valve, by which the whole art of radio communication and of long-distance telephony has been revolutionised.

Our attention has been drawn to this matter by reading in one of Messrs. Henry Wiggin & Co.'s informative booklets on resistance alloys, &c., that a Frenchman named Placet discovered the valuable properties conferred on non-ferrous alloys by the metal chromium as long ago as 1896; not until ten years later was the matter taken up on a commercial scale, and still more recent was its serious consideration by British manufacturers. Yet it now plays a most important, even indispensable, part in the production of durable elements for all kinds of heating appliances. Probably there are many other valuable hints contained in old journals, proceedings of societies, and Patent Office records, the discovery of which would amply repay the labour expended in finding them.

Public Lighting Principles.

THE first general meeting and conference of the Institution of Public Lighting Engineers and Superintendents, held in Glasgow from September 16th to 18th, was the occasion of the presentation of several interesting papers, although to experts most of the views expressed and suggestions made will be familiar. It is, however, most important that the main principles of good lighting should be brought before the public mind. One notices a tendency to assume that when all is said and done "public opinion" is the test of good public lighting. Unluckily, uninformed opinion on such points is fickle. What is needed is to make the public appreciate how important good lighting is, and to encourage them to sanction the aid of experts.

At present, as was remarked in Mr. H. T. Harrison's paper, street lighting consists of two parts, that provided by the public authorities, and that furnished by the headlights of motor-vehicles. If the former were adequate, the latter would be superfluous. At the same time, one cannot quite accept the view that the convenience and safety of traffic are the *only* consideration, and that light must, therefore, be concentrated exclusively on the roadway, leaving the upper part of buildings in obscurity. Something is due to pleasing and cheerful effect; any extraneous aid, such as that furnished by well-lighted shop windows, and even illuminated signs, is valuable in creating a more cheerful appearance. The special "arterial" roads connecting important towns, now under construction, present quite a different problem. In their case the requirements of traffic form the fundamental consideration. The method of lighting such thoroughfares needs serious consideration, and we imagine that in this case the principle of concentrating all available light on the roadway would meet with general approval.

Safety as an Obsession.

FAR be it from us to deprecate the observance of every precaution to secure the safety of the individual—within reason; but are we not apt to overstep reasonable limits in some directions, whilst falling far short of the ideal in many others?

The danger incurred by a person who steps off the footpath with his back to approaching vehicles is so great nowadays that a movement was started to induce pedestrians to "walk on the left"; little success was achieved, but the principle was right—namely, to teach people themselves to be careful. The safety-above-all enthusiast, however, would demand a fence along the kerb, so as to make it impossible for the walker to step into danger. Again, the open fire-place is undoubtedly a source of risk to life and property; were it to be introduced nowadays, the insurance companies would insist on safeguards against outbreaks of fire, and humanitarians would require it to be fenced. If gas

lighting were an innovation, what elaborate precautions would have to be taken against the ignition of ceilings, curtains, &c., and against leakage from the pipes!

Accidents do happen and will continue to happen from all these causes, and many others that we meet with in the daily round—one may fall downstairs, or scratch one's finger with a rusty nail, and perish—but it is recognised that "in the midst of life we are in death," and no one makes a fuss about them.

In view of these considerations, why do we permit officials to ring us round with costly and often unnecessary restrictions and hindrances to progress, for the purpose of reducing loss of life by one in a million? In this respect we go much further than other nations, with serious consequences to our ability to compete with them—for every such restriction, by adding to capital cost, ultimately increases the cost of living and of production.

We have not far to seek for examples. A notable one may be found in the protection required for overhead wires distributing current in rural areas at pressures not exceeding 250 volts, which in other countries are strung up as freely as telephone wires. The absurdity of the position is manifest from the fact that bare trolley wires at a pressure of 500 volts are carried overhead in the busiest thoroughfares of our large towns, but no one worries about them, and accidents are rarely heard of. The "safeguards" imposed upon the use of overhead supply wires greatly increase the cost of erection and maintenance, and detract from the appearance of the work.

Many precautions are laid down for observance by workpeople which the latter deliberately ignore. Others have been known actually to increase the danger they were intended to avert, because a safeguard which (unknown to the worker) is out of order breeds misplaced confidence.

The new Factories Bill, which will shortly come under Parliamentary consideration, contains a large number of provisions designed to add to the safety and comfort of factory occupations—incidentally extending materially the scope of the term "factory"—and legislates for the minutest details of construction and management, some of which are simply funny. It is fortunate that the new provisions apply largely to new or reconstructed factories. At a conference held by the Industrial Welfare Society at Oxford last week, when the Bill was under discussion, pointed criticism was directed at some of the clauses, and members of the Society wondered how manufacturers were to carry on their work, expressing the opinion that the Bill must have been drawn up by people who did not understand industry.

The British Empire Exhibition.

THE fact that we have had no summer worth mentioning does not affect the working of the calendar, which informs us that autumn has begun; and we are reminded that the British Empire Exhibition will remain open for only five weeks longer. Whether it will reopen next year is not yet settled; but it may be regarded as certain that if it does, it will bear a very different complexion, especially in its engineering features. Hence we again urge those of our readers who have not yet visited the Exhibition to make a point of doing so whilst it is still possible to see it in its present form, and on no account to "wait for next year."

The virtues of electricity have never before been demonstrated so efficiently or on so large a scale, and it is important that not only the readers of these pages, but also their clients—the actual or potential users of electrical apparatus—should visit the Exhibition, to see there how electricity can minister to their comfort and convenience. The E.D.A. display is there for that purpose, and affords the fullest facilities for the demonstration of electrical ways of doing things about the house, and for obtaining information regarding the apparatus used, as well as the terms upon which the service can be provided in the visitor's own locality.

How many of our readers have given opportunities to the members of their staffs to spend a day at Wembley? Have the managers of electricity supply undertakings realised that in a few hours their employés, besides having an enjoyable outing, can be given a liberal education in the variety, convenience, and use of the appliances they are called upon to introduce to consumers? Where are the contractors, whose absence was commented upon by a contributor to our pages recently? They may believe that they know all that need be known about their business, but we will wager that not one of them who explores the E.D.A. exhibit thoroughly will fail to learn something new. There will never be so good an opportunity again.

Moreover, if we have stressed somewhat the merits of the supply industry's collective exhibit, we are far from suggesting that there is nothing else to be seen. To study adequately the fascinating exhibits which fill the huge Palace of Engineering alone would occupy many months; even the least technical visitor will find himself (or herself) unable to walk through the Palace without pausing here and there for a closer inspection of some attractive item, and to do justice to the other sections of the great Empire show would require volumes. Readers who do not go soon enough to have time to go again will regret their lost opportunities when it is too late.

The Government and Industrial Associations.

ABOUT a month ago it was announced in the daily Press that the Prime Minister was in communication with representatives of industries that would be most seriously affected by European combinations against British trade and that a committee was to be set up to advise the Foreign Office on the subject. Probably the Government is still thinking about the matter. If so, it will be assisted in doing so by a letter that was addressed to it by the Federation of British Industries at the end of last week on the subject of future commercial arrangements with Germany. France and other countries are already busy on the preparation of commercial treaties with Germany, and it is pointed out that unless His Majesty's Government takes similar steps to secure at least most-favoured-nation treatment before January 10th, British trade will find itself left in a most disadvantageous position. We hope that the Government will see the wisdom of keeping in close touch with the trade organisations in this country competent to advise them on such matters. The Federation letter suggests a return to the war-time practice of a composite committee consisting of representatives of Government departments and of the industrial organisations.

French Railways and Coal Economies.

IT is expected that the planned conversion of the principal lines in France to electrical working will bring about a very considerable economy in the consumption of coal—a matter of great importance to a country which still finds it necessary to import large quantities of fuel.

In 1913 France imported 22,000,000 tons of coal, and the consumption of the railways alone in that year amounted to some 12,000,000 tons, representing an outlay of over £10,000,000 at the then rate of exchange. Out of the total mileage of 24,800 it is proposed, under the scheme already being carried out, to electrify some 5,642 miles during the next 18 or 20 years. It is calculated that the execution of the complete scheme, which is to be effected mainly by the utilisation of water power of 1,060,000 h.p., will bring about a coal saving of 1,470,000 tons per annum on the basis of the traffic in 1913, but the traffic is expected to be twice that of 1913 when the electrification project has been completed, so that the coal economy by that time will be approximately 3,000,000 tons. At present the work of electrification has made most progress on the Midi line; the Paris, Lyons, and Mediterranean comes second, and the Paris-Orleans railway third.

D

Automatic Sub-Stations at Manchester.

Two Sets of B.T.H. Equipment.

THAT the City of Manchester's electricity undertaking enjoys the well-earned reputation of being one of the most progressive in this country, is due in no small measure to the policy and guidance of its chief engineer, Mr. S. L. Pearce, M.I.E.E., who will shortly have in daily service four fully-automatic rotary-converter sub-stations.

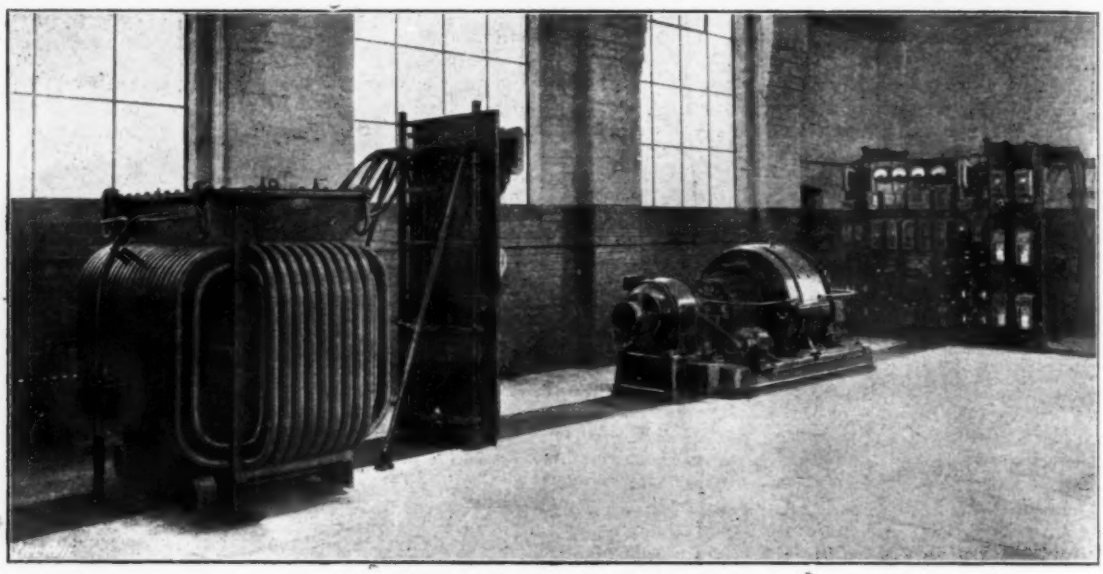


Fig. 1.—Automatic Sub-station at Longsight, Manchester.

The stations are being equipped by three different firms, and two of them, by the British Thomson-Houston Co., Ltd., are already in operation. The Longsight sub-station was commissioned in March and that at West Didsbury in June, 1924. The two sets of equipment are practically duplicates and, so far as the essential apparatus is concerned, very similar to the installation described in our issue of August 22nd, 1924, p. 280, and the plant exhibited at the British Empire Exhibition.

The accompanying illustration of the Longsight plant, fig. 1, indicates that the lay-out of the equipment is such as to make the cabling as simple as possible, there being a straight run through from the h.p. cubicle to the d.c. switchboard. The incoming a.c., 3-phase, 50-cycle supply is at 6,400 volts, and the machine feeds into the d.c., 400-volt, 3-wire system. The equipment consists, as shown in fig. 2, of two cubicles, one containing a hand-operated triple-coil oil circuit breaker, with isolating switches and the usual automatic features, and the other a small single-phase power transformer to furnish 220 volts for operating the controlling devices. The Brush oil-immersed self-cooled transformer is rated at 550 kVA and 6,450/311 volts, the h.p. winding being delta connected and the l.p. side six-phase diametric. An automatic panel takes the place of the usual starting gear and carries six contactors (*i.e.*, one for starting, one for running, one neutral, and three field), the function of which will be apparent from the description of the sequence of operations. The rotary converter, fig. 1, is a standard 500-kW, 1,000-r.p.m., 400/440-volt, shunt-wound, three-wire machine provided with the usual accessories, *i.e.*, self-synchronising starting induction motor, and speed limit and end-play devices; in addition, it is equipped with bearing thermostats, starting-motor stator thermostats, an earth relay, an auxiliary field winding for fixing the polarity, and a small belt-driven generator to excite this winding. A motor-operated field rheostat is provided for the main field of the rotary, and also rheostats for the auxiliary field winding and the auxiliary generator, all mounted behind the d.c. board, on which, in addition to the main d.c. circuit breakers, are mounted all the relays for controlling and protecting the machine, as shown in fig. 3. Behind this panel is mounted the motor-operated master controller, which fixes the sequence of switching operations when starting up or shutting down.

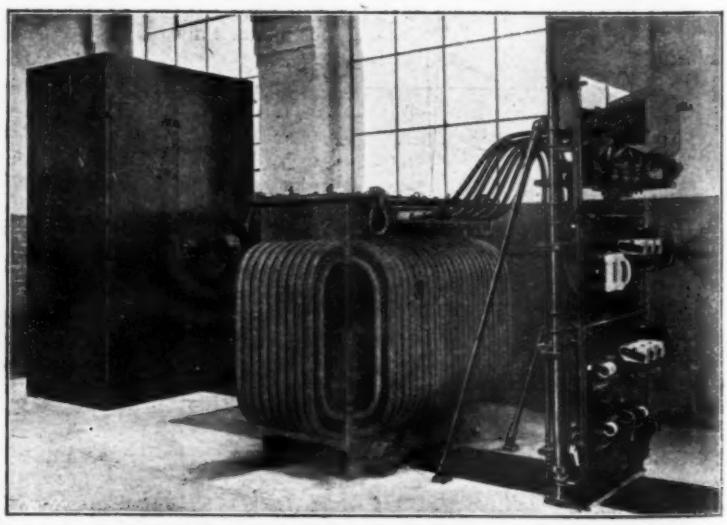


Fig. 2.—A.C. Starting Switchgear.

Sequence of Operations.

The sequence of switching operations may be readily followed by reference to the key diagram, fig. 4; it does not indicate the actual relays, but the contacts, operating coils, &c., are grouped in their respective electrical circuits irrespective of their relative physical positions. The figures in parentheses correspond to the numbers on the diagram.

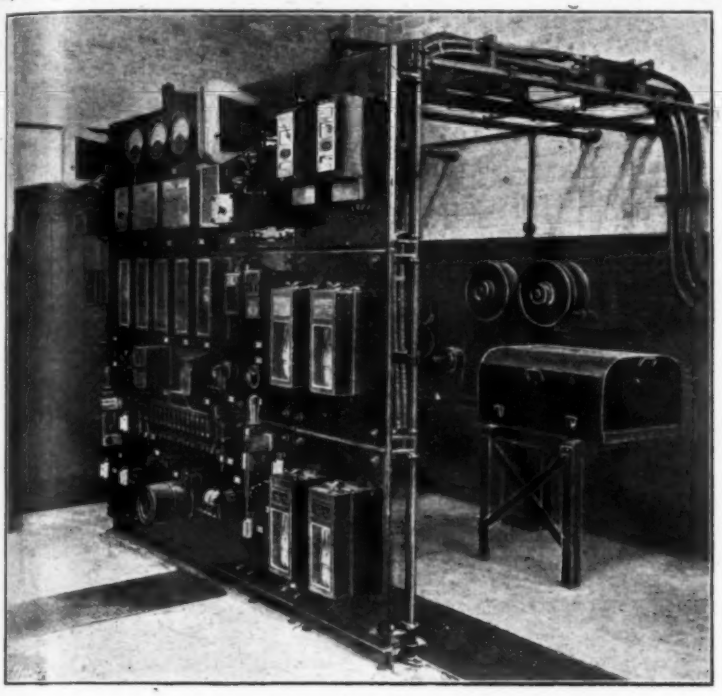


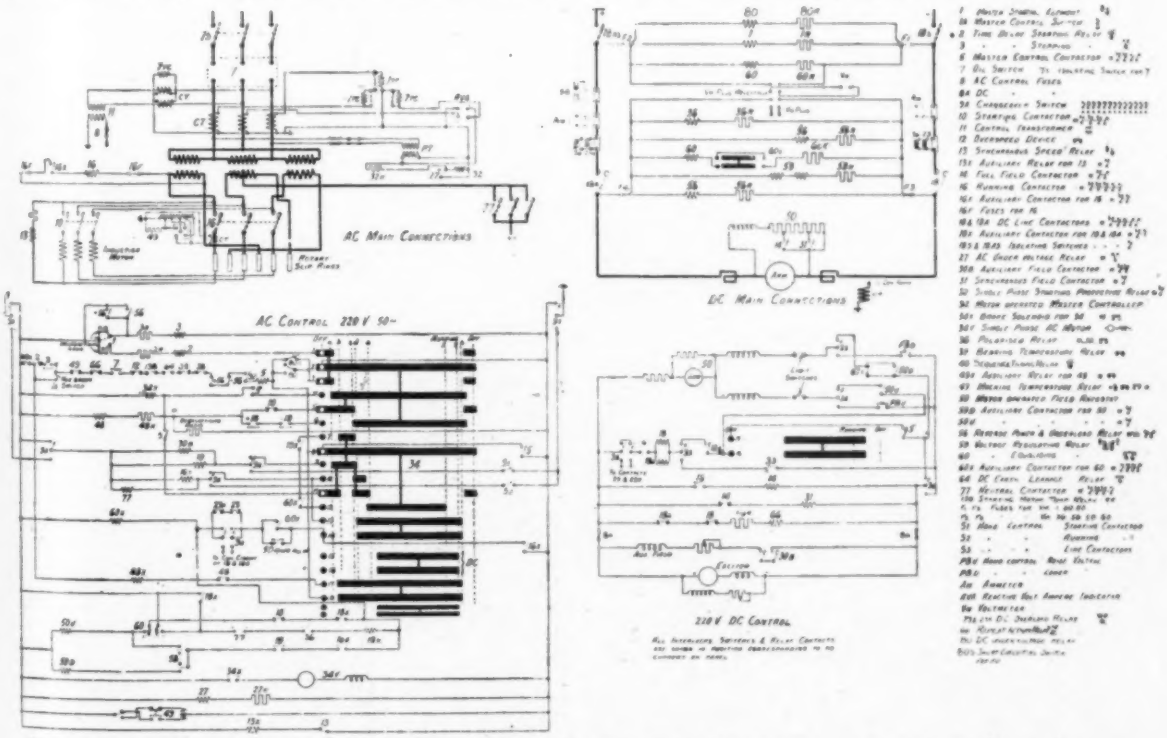
Fig. 3.—D.C. Board and Automatic Gear.

Under normal conditions the rotary converter is started and stopped entirely by load demand, but a number of small control switches are provided, by means of which the machine can be started up automatically at will for inspection or operated by hand.

When under fully automatic control, the multiple change-over switch (9A) is closed on to its top contacts and the main oil circuit breaker is left permanently closed. As a result, the main and control transformers are energised and, provided that the a.c. voltage is above a predetermined value and that all three phases of the high-pressure supply are alive, the a.c. undervoltage relay (27) and single-phase protective relay (32) close; the sequence timing relay (48) and auxiliary relay (13x) are also energised.

The starting impulse is given by contact making voltmeter (1), the coil of which is connected between the positive and negative d.c. line terminals; so long as the d.c. voltage remains normal, the lower contacts of this relay are closed, thus energising time delay starting relay (2) through segments 1 and 2 of the master controller (34). A drop in the d.c. voltage of a predetermined amount causes the arm of relay (1) to swing over from the bottom to the top contact, thus energising time delay stopping relay (3), which instantaneously closes its contacts and de-energises time delay stopping relay (2) by inserting a de-magnetising resistance in its coil circuit.

At the end of a definite time interval, in this particular case about 45 seconds, time delay starting relay (2) closes its contacts, provided that the d.c. voltage has not returned to normal in the interval. The object of this time delay is to prevent the machine being started up by momentary fluctuations in the d.c. voltage. Should the d.c. voltage remain below normal for a sufficient length of time, time delay starting relay (2) will in due course close the coil circuit of the master control contactor (5) through the various protective devices, segments 2 and 3 of the controller, and the contacts of relay (80). This relay only closes its contacts if the voltage of the d.c. system is above a predetermined minimum value, and the equipment is thus prevented from starting up if the d.c. network is dead. The reason for this is that, after a total shut-down of the system, the automatic sub-station would start up immediately the a.c. voltage was restored and would connect itself to the d.c. system long before it was possible to start up a manual station, with the result that it would attempt to "grab" the whole d.c. load. This contingency is prevented by relay (80).



Sequence of Operation.—Automatic drop in volts operates Relay No. 1 after time delay (Relay 2). Controller 34 starts. (a) Starting Contactor 10 closes; (b) Controller stops, waiting for machine to synchronise; Controller restarts after machine has synchronised. (c) Running Contactor 16 closes. (d) Starting Contactor 10 opens. (e) Machine volts reduced to minimum and 60 closes. Machine volts raised to line volts by 60 and Line Contactors 18 connect machine to bars. (f) Controller 34 stops in running position. Volts kept at normal by Relay 58. Hand Control: Throw Change-over Switch 9A down. Close 81, machine starts. Close 83 when machine has synchronised. To raise volts operate PBU. To lower volts operate PBD. Close 83 to connect machine to bars.

Fig. 4.—Diagram showing the Sequence of Operations.

Master control contactor (5) has four contacts, three normally open and one normally closed. Of the normally open contacts, two are provided with magnetic blow-outs and control the a.c. and d.c. "control supply" respectively. The remaining normally open contact and the normally closed contact

are used for interlocking purposes. When the contactor closes, one of its normally open main contacts completes a retaining circuit for its own coil, independently of segments 2 and 3 of the controller. It follows that once the controller has left the "off" position, should master control contactor (5) open through the operation of one of the protective devices, it cannot reclose until the controller has again reached the "off" position. To run the controller to the "off" position in these circumstances, the normally closed interlocking contact on the master control contactor (5) completes the circuit of brake solenoid (34x) through segments 2 and 4, and this in turn completes the circuit of motor (34x) driving the controller.

Returning now to the starting sequence, when contactor (5) closes, one of its main poles and its normally open interlocking contact complete the circuit of brake solenoid (34x) through segments 8 and 11 of the controller. The interlock on (34x) completes the circuit for motor (34x), and the controller cylinder commences to rotate, finger 9 making contact with its segment and completing the coil circuit of starting contactor (10) and auxiliary contactor (30B).

The closing of contactor (10) connects the rotary to the transformer through the starting motor, and the machine starts. As there is now full voltage across the starting-motor winding, synchronous speed indicating relay (13) is energised and opens its contacts, thus de-energising the coil of auxiliary contactor (13x), which in turn opens its contacts. A normally closed interlock on contactor (10) de-energises sequence timing relay (48) by inserting a de-magnetising resistance in the coil circuit. Contactor (30B) connects the auxiliary field winding on the rotary to the d.c. exciter to ensure that the machine runs up with the correct polarity.

As the controller cylinder continues to rotate, the following operations take place:—Finger 1 leaves its segment, thus ensuring that the sequence shall not be interrupted by momentary fluctuations of the d.c. voltage, which might cause master starting element (1) to operate and energise the coil of time delay starting relay (2). Finger 3 leaves its segment and interrupts the closing circuit of master contactor (5), which now has an alternative retaining circuit. Fingers 17 and 18 make contact with their segments, thus preparing the coil circuit of auxiliary relay (48x) to enable the contacts of sequence timing relay (48) to complete this circuit if called upon to do so.

Finger 7 makes contact with its segment in preparation for carrying on the sequence when the rotary converter has synchronised. Finger 11 interrupts the circuit of brake solenoid (34x), stopping the controller, which does not restart until the machine has synchronised.

As the rotary speeds up, the exciter, which is belt-driven from its shaft, builds up its voltage and excites the auxiliary field winding to obtain correct polarity at the d.c. terminals. When the voltage of the exciter reaches approximately 80 per cent. of the normal, synchronous field contactor (31) adjusts the strength of the main field of the rotary converter to the correct value for synchronising. At the same time, repeat action relay (66) lifts its plunger, taking one notch, and the motor driving the main field rheostat (50) rotates the arm to the "all resistance in" position.

When the machine is in synchronism, as indicated by the drop in voltage across the induction motor winding, synchronous speed indicating relay (13), after a short time delay, completes the coil circuit of auxiliary contactor (13x). Contactor (13x) completes the circuit of brake solenoid (34x) through segments 7 and 8 of controller (34), and the controller cylinder again commences to rotate.

Finger 11 on the controller next takes over the control of brake solenoid (34x) from the contacts of auxiliary contactor (13x) before finger 7 leaves its segment. Finger 10 completes the coil circuits of auxiliary contactor (16x) and neutral contactor (77). Contactor (16x) completes the coil circuits of running contactor (16), and contactor (77) connects the mid-point of the transformer to the neutral of the d.c. system.

Running contactor (16) short circuits the starting induction motor, thus connecting the rotary converter direct to the main transformer. Finger 6 of controller (34) makes contact with its segment, and finger 5 leaves its segment, thus transferring the control of sequence timing relay (48) from starting contactor (10) to line contactors (18) and (18A). Fingers 13 and 14 on the controller form a retaining circuit for contactors (16x) and (77) through an interlock on contactor (16x). This prevents the possibility of running contactor (16) opening before d.c. line contactors (18) and (18A).

Finger 9 next de-energises the coil of starting contactor (10) and auxiliary field contactor (30B); the opening of (10) disconnects the starting induction motor from the main transformer, and (30B) disconnects the auxiliary field winding of the rotary converter from the exciter. This prevents any possibility of the exciter polarity being reversed due to heavy short circuits or voltage surges, and consequently ensures that the rotary shall always start with correct polarity.

When running contactor (16) closes, its interlocks complete the coil circuit of full field contactor (14), which in turn completes the main field circuit of the rotary through the moving arm of field rheostat (50). An interlock on contactor (14) interrupts the coil circuit of contactor (31), which disconnects the main field from the synchronising tapping on field rheostat (50). Finger 11 leaves its segment and the controller stops until the rheostat arm reaches the "all resistance in" position, as described above.

In this position the rheostat arm completes the coil circuit of auxiliary contactor (60x). Contactor (60x) closes, and one of its interlocks provides a retaining circuit for its own coil in parallel with the contacts of rheostat (50), thus enabling the contactor to remain closed when the rheostat arm moves from the "all resistance in" position to equalise the voltage of the machine with that of the d.c. line. A second interlock on contactor (60x) completes the circuit of brake solenoid (34x) through segment 12 on the controller.

The controller cylinder therefore again rotates, and fingers 15 and 16 provide control power for d.c. line contactors (18) and (18A). At the same time, fingers 19 and 20 complete the circuit of the voltage equalising relay (60), which is across the incoming machine. The other coil of this relay is permanently across the d.c. line.

The cylinder continues to rotate until the running position is reached, when finger 12 leaves its segment, thus de-energising brake solenoid (34x) and bringing the controller to rest.

A third interlock on contactor (60x) completes the coil circuit of auxiliary contactor (50U) through the contacts of voltage equalising relay (60). Contactor (50U) completes the circuit of the motor-driven main field rheostat (50), causing the rheostat arm to rotate so as to cut out resistance and raise the voltage of the rotary.

When the rotary voltage is equal to, or slightly greater than, the line volts, relay (60) disconnects contactor (50V) and completes the coil circuit of auxiliary contactor (18x), provided that the contacts of polarised relay (36) are closed; this indicating that the polarity of the rotary converter is correct. When auxiliary contactor (18x) closes, its main pole completes the coil circuit of line contactors (18) and (18A), while its interlock contact forms a retaining circuit for its own coil, which bridges the contacts of relay (60).

D.c. line contactors (18) and (18A) now connect the rotary converter to the d.c. mains. One set of interlocks on the line contactors de-energises notching relay (66), which returns to its normal position. A second set of interlocks short-circuits the de-magnetising resistance of stalling relay (48), and a third set removes the control of contactor (50U) from relay (60), while a fourth set transfers the control of contactors (50U) and (50D) to voltage regulating relay (58).

One pole of relay (58) controls contactor (50U) so as to raise the rotary volts, if low, by cutting out resistance from motor-driven field rheostat (50). The other pole controls contactor (50D) to reduce the voltage, if high, by inserting resistance. The position at which the contact arm of motor-driven rheostat (50) trips the limit switch can be adjusted so that it is impossible to alter the field strength of the rotary converter to a value which will give a poor power factor on the a.c. side.

Relay (58) is provided with compound coils, adjusted to give the machine a rising characteristic so as to compensate for voltage drop in the feeders as the load increases. As load comes on to the rotary converter, the under-load contacts of relays (56) bridge the normally closed contact of relay (1) and keep time delay stopping relay (3) energised, notwithstanding the fact that the voltage is now normal and relay (1) has opened its top contact. The rotary will now run in parallel with the d.c. system until shut down by a reduction of load or by the operation of some protective device.

(To be concluded.)

French Electricity Consumers' Complaints.—The committee of management of the Chambre Syndicale des Consommateurs d'Electricité de France, Paris, is taking action in connection with complaints made by customers of electricity supply undertakings in various districts of frequent breakdowns and high tariffs. Desirous of obtaining from the Government a more equitable regulation of the distribution of electricity, the committee has asked the heads of the local authorities, manufacturers, and private persons concerned to forward detailed particulars of their complaints and of the prices charged. In the opinion of the committee the distribution over considerable areas of territory of the electricity produced in the large generating stations, which are being substituted for the small stations and restricted networks, is not without serious inconvenience to consumers. The length of the lines and the number of transformer stations and of private installations, it is submitted, multiply the causes of breakdown. It is urged that the system of distribution should be improved by at least dividing up into sections the zones served by the same generating station. As to the question of tariffs, which vary greatly in the same regions, the committee expresses the wish that charges should be revised or established by consultative commissions similar to that which already acts in Paris and the body which is to be created also for the suburbs of the capital.

Electric Coal Cutters.—In his report on Mines in Scotland for 1923, Mr. J. Masterton, H.M. Inspector of Mines, shows that the use of coal-cutting machines is extending in the mines, the electrically-driven machines of the disk, bar, or chain types being favoured; of the 512 mines at work, 273 made use of coal cutters. The output from the machines was 17,348,494 tons, an increase of 3,039,021 tons over the previous year's output.

Electric Vehicles at Wembley.

Some of the Battery-driven Exhibits.

(*Concluded from page* 435.)

The "Paragon" Battery Locomotive.

In the Palace of Engineering, Messrs. R. W. Hawthorn, Leslie & Co., Ltd., have an exhibit of considerable interest in the form of the electric battery shunting locomotive illustrated in fig. 8. They have adopted the "Paragon B. & B." system (Capt. W. P. Durtnall's patents), which is novel in several ways—there are no wasteful resistances as with the series-parallel control type; all locomotive speeds are equally efficient

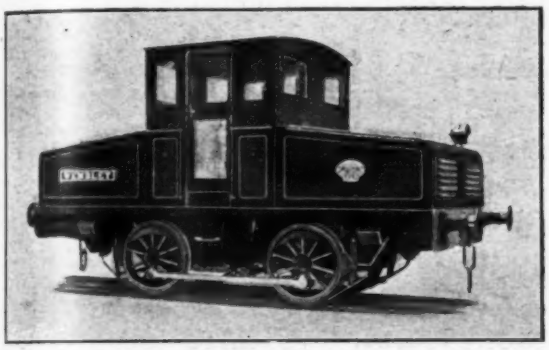


Fig. 8.—The "Paragon" Battery Locomotive.

(18 speeds in both directions are incorporated in the 50-h.p. size); and one electric motor drives all four wheels. Regeneration is secured right down almost to standing point; a fair return of energy is thus secured, particularly when descending grades at any of the many given locomotive speeds. In slowing down the locomotive and train, the kinetic energy is arrested and is regenerated in the form of electrical energy, which is automatically returned to the battery; a large reduction in the wear and tear on brake shoes and tires is obtained, which consequently reduces the maintenance costs. Comparing the "B. & B." system with the series-parallel type, it is possible, in certain cases of haulage duty, to eliminate from 30 to 40 per cent. of the cell capacity required by the latter type, with a consequent reduction in charging costs. Every time the locomotive is slowed down or stopped, the battery receives boosting charges, which take place automatically (independently of the driver), and the cells are thus not brought down to the fatiguing point and then recharged at an inefficient rate. The discharge from the cells during operation is gradual, no excessive peaks in the current from the cells need be brought about.

A transformer supplies current at a controllable variable voltage to the driving motor, and in, *e.g.*, a 100-volt "B. & B." locomotive, the cells may be charged from a 250-volt d.c. circuit without the use of resistance or a separate motor-generator set; also a 250-volt d.c. locomotive can be charged directly from any circuit up to 500 volts. Should the charging supply be single or polyphase a.c., it can be transformed on the locomotive with slight alteration to the d.c. lay-out. The system operates on a closed circuit, all control being carried out at a low voltage.

The engine shown is of 4 ft. 8½ in. gauge; it has four coupled wheels 3 ft. 3 in. in diameter and a wheel base of 7 ft., and weighs in working order 15.6 tons. The driving motor is only of 50 b.h.p. on one-hour rating, and the tractive force is 5,545 lb. at 2.875 m.p.h. The battery supplies at constant voltage the motor of an "electro-kinetic transformer," the generator of which supplies variable-voltage current to the main driving motor, according to the field conditions regulated by an 18-step controller. The driving motor is mounted on the main frame of the locomotive, one axle being driven by worm and spur gearing. The whole weight is utilised for adhesion by the use of outside coupling rods. The battery consists of 96 "Kathanode" cells, T.R. 21-plate type, having a 240-ampere-hours capacity at the 5-hour rate of discharge, manufactured by the D.P. Battery Co., Ltd. Reversing is accomplished by changing over the leads to the main motor. The reversing, when in a central position, cuts out the main motor, and the charging leads are coupled to the generator of the electro-kinetic transformer, the controller being adjusted to suit the voltage of the supply. The generator, under these conditions, acts as a motor, and the motor of the transformer as a generator, the latter supplying current at 192 volts to the battery.

Industrial Battery Trucks.

The general utility battery-driven truck exhibited by Messrs. Greenwood & Batley, Ltd., is illustrated in fig. 9; it is designed for a load of two tons, but is capable of carrying a considerably heavier load occasionally. The truck is driven by a 25-volt series-wound motor, rated at 2 h.p. at 1,100 r.p.m., and capable of carrying an overload up to 300 per cent. The power is transmitted to the rear axle by a universal joint and a cardan shaft. The reduction gear to the driving shaft is a worm and wheel fully enclosed and running in oil. The bearings throughout the machine are roller or ball type. The truck is fully sprung. The controller gives three speeds in the forward and reverse directions, and is interlocked with a cut-out worked by a foot lever. The battery supplied gives a voltage of from 25 to 30, and has a capacity of 200 amp.-hours. A Chloride Co.'s Exide-type battery can be supplied or, alternatively, a nickel-iron battery made by Messrs. Batteries, Ltd., whichever is preferred.

Messrs. British Electric Vehicles, Ltd., have on view their largest and smallest models. The former is the "Super-Giant" truck, which, having a carrying capacity of 5,000 lb., is more in the nature of a small lorry. It has a loading space measuring 8¼ ft. by 4 ft., and a wheel base of 5¼ ft. The springs are of the semi-

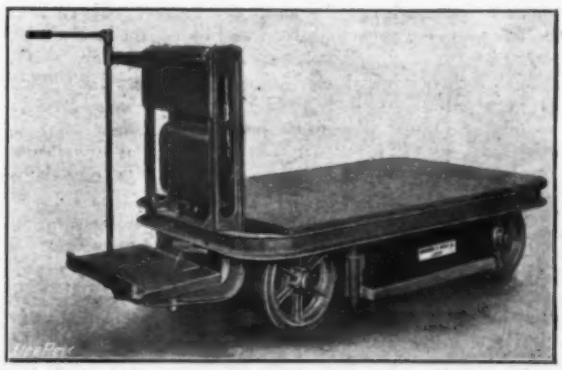


Fig. 9.—A Greenwood & Batley Truck.

elliptic pattern and the motor is fixed near the front axle, and the drive is taken through a cardan shaft to a worm wheel. The battery is mounted in the middle of the truck beneath the loading platform, and is substantially cradled. Space is provided for a battery of 20 cells of a total capacity of 160 Ah. The controller gives three speeds in either direction, and is operated in conjunction with a special trip gear that does away with accidental starting.

The "Midget-Whippet" truck, which is said to be the smallest electric truck made, has a carrying capacity of 750-1,000 lb. It has three wheels, two mounted on the driving axle, and the other on the steering axle. Space is provided for a battery of 14 cells, with a total rating of 96 Ah. The motor is fixed to the underside of the frame by means of adjustable slings, and the transmission is by a roller chain gear giving a downward ratio of 4.4 to 1. This truck can negotiate 4-ft. gangways at right angles to each other.

The other exhibit is an electric locomotive for use on tracks of gauges from 18 in. upwards. The motor is wound with two fields for series-parallel control, and is supplied with energy by a 24-cell, 216-Ah accumulator. A drum-type controller is fitted; this is capable of withstanding currents up to 100 A continuously. A bulkhead lighting fitting is provided at each end, with a switch to ensure that only one light is on at a time. If required, the locomotive can be fitted with overhead trolley gear in place of the battery.

In the bread bakery section in the Palace of Industry two industrial-type trucks are used for transport purposes. They were made by Messrs. Ransomes, Sims and Jefferies, Ltd.; each is capable of carrying a load of 4,000 lb., and is fitted with a "Kathanode" T.R. 20-cell, 13-plate battery by the D.P. Battery Co., Ltd.

A Petrol-Electric Chassis.

In the motor-car section of the Palace of Engineering a type T.S.6 chassis fitted with forward steering, petrol-electric transmission and final worm drive is the exhibit of Tilling-Stevens Motors, Ltd. The engine has four cylinders and the bore is 4½ in. and the stroke 5½ in., the nominal h.p. being 40. The chassis, which weighs approximately four tons, has a maximum load capacity of five tons, including the body. The wheelbase is 15 ft. 6 in., and the track 5 ft. 8 in. The Tilling-Stevens petrol-electric chassis is largely used for passenger omnibuses and, being devoid of clutch and gear-box, it ensures smooth and easy running. The chassis is also adaptable for municipal purposes, such as tipping and tower wagons and fire engines.

How Circularising can Help the Retail Electrical Trade.

By ERIC N. SIMONS.

THE great advantage of circularising for the retail electrical trader is its comparative cheapness and economy. As a means of finding business it ranks among the most successful, and it requires little organisation to make it effective in the highest degree. The retailer must bear in mind that by no means everything electrical sold in his shop is extensively advertised by its manufacturers. On his premises, kept in stock, can be found many things of which the ordinary man or woman has no knowledge. Even those goods that are advertised are not known to everybody, because the advertising varies in quality and appeal, and may have been going on for years without attracting as much attention as it ought to have done in view of the money spent on it. Similarly, it must be remembered that the housewife does not enter the shop of an electrical trader with the same eager anticipation that marks her entry into a draper's or grocer's. She comes with a definite want in her mind. That satisfied, the sooner she can leave the shop the better. There is no belief in her heart that by looking round a little she can pick up a novelty here, a bargain there. Obviously, then, her knowledge of the retailer's stock is extremely limited. It is his task to introduce her somewhat more forcibly and appealingly to the wide range of interesting—and electrical appliances, &c., *are* interesting—articles he sells. The postal circular ranks among the best ways of doing this.

Traders must not imagine that circularising competes with or supplants advertising as a means of selling. It does nothing of the kind. It is auxiliary and supplementary. The difference between the two forms is this: that advertising to be most fruitful must be continuous; circularising is most fruitful when intermittent. Electrical traders should send out circulars only when they have something of real interest to say to their customers. Otherwise the effectiveness of the circular is lessened.

It will be as well to summarise briefly the advantages of circularising. First of all there is particularisation. A retailer can select from his lists just those very people who, he knows, are likely to be interested in the goods or appliances to which he wishes to draw their attention. In advertising, he advertises to all and sundry. In postal circularising, on the other hand, he limits his appeal to the persons most likely to respond. A limitation in this way has the effect of concentration. Another advantage of circularising is its inexpensiveness. Apart from the cost of postage, which need not be heavy, all that is required is a machine for duplicating the circular letter, and the expenditure of a little care and time on addressing the envelopes and preparing a sound mailing-list. A quite good duplicating machine can be obtained at a very moderate price, and will easily earn its cost in a short time if judiciously used.

It becomes necessary now to consider in what way circularising can be turned to the best advantage. It is an axiom in selling by this method that the most effective procedure is for the retailer himself to write a letter to his customers or potential customers, this letter being accompanied by a printed enclosure describing the goods in detail. The printed enclosures are usually pamphlets, booklets, leaflets, or other forms of publicity matter, supplied in quantities for distribution by the manufacturer. Sometimes the letters cover the despatch of price-lists, catalogues, and so forth. The point is that they should be framed so as to induce the person who receives them to read the enclosures carefully. The enclosure itself sets forth the arguments for the goods. The circular letter is intended to arouse the reader's curiosity, draw his attention to the goods, and make him anxious to learn more of them from the printed matter.

Obviously, a circular letter of this kind needs considerable thought. An electrical retailer who questions his own ability to frame an efficient letter will often find it to his advantage to put his problem before the actual manufacturer of the goods he wishes to sell. Many manufacturers of electrical goods employ well-equipped sales specialists, whose help in drafting circular letters will often be granted willingly, and prove of great benefit to the retailer.

Circular letters should be short, but not abrupt. They should keep closely to the subject, yet not be too bald. A little touch of the personal makes the letter read more easily, but familiarity should be avoided. An offer of help, either in demonstrating the appliance, in sending it up for trial, or in supplementing the information given, often makes a letter read sincerely, but officiousness must not be introduced. And finally, the circular should give, succinctly, the main talking-points of the article discussed, without, however, revealing

them all; and should endeavour to prove that the reader will benefit by its purchase. The reason why all the talking points should not be given in the letter is that it partly destroys the reader's incentive to read the enclosure, wherein all are contained. The letter should, therefore, make it clear that other advantages are mentioned in the literature enclosed.

An example of how the advantages of electrical appliances can be brought strikingly and in a timely way before a possible consumer is supplied by a retailer of electrical goods in a provincial town. This man, being far-sighted and industrious, makes a practice of going through the correspondence columns of the local morning and evening journals. Occasionally, from the letters published, he gathers information unconsciously revealed concerning possible purchasers in his district. This information gives him the opportunity for striking a personal note in circular or special letters addressed to them. Thus, one person wrote to the papers complaining of the poor quality of the town gas. He at once received a letter from this retailer pointing out how, without drastic alterations or enormous expense, electricity could gradually be introduced into the home, thus cutting down to a minimum the inconvenience due to poor gas. The letter brought the customer to the shop; and eventually he become a very good friend to electricity. A letter sent off at the right psychological moment, as this was, is worth a hundred sent out haphazardly on the off chance of their being timely.

How should circulars be delivered? This is another question that intimately concerns the retailer. Broadly speaking, circularising for retailers can be separated into two forms: by post and by hand. These two forms can again be split into two divisions, thus:—

1. Postal circularising:
   (*a*) In sealed envelopes by 1½d. post.
   (*b*) In unsealed envelopes by ½d. post.
2. Hand-delivered circulars:
   (*a*) Delivered from door to door.
   (*b*) Delivered to passers-by outside the shop.

Of these two forms, there is no question that the first is the more effective. It attracts more attention; it is more dignified; and in the long run it is vastly more effective. The great advantage of a circular sent through the post is that in ninety per cent. of cases it will reach the person for whom it is meant, even though it may be consigned to the fire or the waste-paper basket the moment after it is opened. On the other hand, the circular thrust through the letter-box, or under the door, by a messenger boy during the day is often torn up and thrown away by servants who object to litter. The person addressed knows almost as soon as he sees it that it is not an important communication, whereas a letter posted has about it always the possibility of importance. Yet circularising by hand is better than no circularising at all, a point that needs to be borne in mind.

The 1½d. stamp gives to a circular letter all the dignity of a real postal communication; it looks like a letter. It is businesslike; and it is read because the receiver of it is affected subconsciously or otherwise by the knowledge that someone has spent 1½d. in order to send it to him. Furthermore, it looks less like an invoice or bill, and therefore does not set up antagonism before it is opened. But although there are, as will be seen, strong arguments in favour of it, the 1½d.-stamped sealed circular is not so very much more effective than the unsealed as the theorists would have us believe. The writer's experience has been that if the letter and its enclosure are sufficiently interesting, they will be read whatever the manner of their postal arrival. There is this to remember, that a person opening a sealed envelope in the expectation of its being a letter, but finding only a circular, is sometimes disappointed, and therefore not in the best frame of mind for attending to it. For most circularising purposes, particularly where electrical appliances are concerned, the 1½d. post is quite good enough.

It has been asserted by some retailers, though not those specially connected with the sale of electrical goods, that they have succeeded in increasing the business brought to them by their circular letters through using coloured envelopes instead of plain white or cream. The argument is that the coloured envelope stands out from among others, is unusual, and therefore attracts more attention. The writer admits that he is sceptical on this point. Apart from anything else, tinted envelopes never have the dignity and restraint that the white possess. Still, there is always room for experiment in selling, and this experiment in particular will cost little and may prove successful. It is often apparent trivialities that bring success.

A most important factor in efficient circularising is the mailing-list, and on this point a few words must be written. Only likely names should be included. Every electrical dealer knows with fair accuracy the extent of the district for which he caters, and by means of a local directory and his past and current order-books he can build up very quickly a sound and efficient list. At the same time, his task does not finish there. The list must be kept up to date. Nothing annoys a householder more than the receipt of letters addressed to a previous tenant. He hardly cares to regard them as his own, yet he dislikes the trouble of returning them to the postal authorities. It does not solve the difficulty to add "or present occupier." The householder thinks to himself that the retailer, who lives in his own district, might at least have taken the trouble to find out who *is* the present occupier.

For preference, mailing lists should be kept in the form of little cards containing the required particulars, stored in a little cabinet. It will be found an advantage to keep the cards in geographical and numerical order rather than in alphabetical, *i.e.*, in streets, roads, and house numbers. In this way changes of tenancy can be recorded more easily. If the customers' names are filed alphabetically, and a change of occupancy takes place, the retailer who happens to have forgotten the name of the original tenant of, say, No. 10, Howard Street, has to look all through the file for the card required. But if all the Howard Street cards are filed together, it is a second's task to make the necessary alteration. Cards are preferable to sheets, because they are more easily referred to, last longer, and are more readily storable.

"Shocking Fish."—An "electric eel" from South America, over 4 ft. long and nearly 4 in. in diameter, is now on exhibition in one of the tropical freshwater tanks in the Zoo's new aquarium. The electric eel is allied to the catfishes, and is able to give a severe electrical shock of from 400 volts upwards, apparently at pleasure. When it is handled, or even lightly touched, almost at once a succession of shocks can be given over a considerable period without exhausting the fish, probably partly for protection and partly to kill the prey.

Four other kinds of fish have electrical organs. The torpedo rays of the Atlantic and Indian oceans, belonging to the genera *Raia* and *Torpedo*, may attain a width of from two to three feet, and can disable a man by a single discharge. *Malapterurus*, with three species, is a catfish of freshwater tropical Africa, one of them inhabiting the Nile. The *Mormyridae* are a family of fresh-water African fishes remotely allied to the herrings, all of which have developed electrical organs.

The electrical organs have been studied both anatomically and physiologically by many investigators. They all consist of a large number of plates arranged in series, and the high voltage, which may be above 450, is obtained by the simultaneous electrical excitement of each of the plates. Except in *Malapterurus*, where the organ is developed from skin glands, the actual battery consists of a number of modified muscle plates arranged along the sides of the body. These are richly supplied with nerves, and the end-plates, or terminations of the nerves in the muscles, are regarded as the active part. But skin papillæ are also concerned, and the organ as a whole is more quickly fatigued than nerve fibre, although less so than muscle. The fishes themselves are almost insensible to electrical shocks.—*The Times.*

Australian Dumping Duty Exemptions.—Under the Customs Tariff (Industries Preservation) Regulations, 1924 (No. 99 of 1924), the following goods are exempted from dumping duty under Section 4 of the Act:—All goods in respect of which the difference between the fair market value and the export price does not exceed 5 per cent. of the fair market value, except such goods or classes of goods as the Minister for Trade and Customs may specifically direct shall not be so exempted.—*Board of Trade Journal.*

Power Transmission Lines: Aspects of their Design.—IV.

By WILLIAM T. TAYLOR, M.Inst.C.E., M.I.E.E., Fel.Am.I.E.E.

THE fundamental requirement for any line is to have it give the most reliable continuous service for the lowest annual cost of interest, depreciation, maintenance, taxes, and operating expenses. The most economical line is that which produces the lowest annual cost and the highest earning capacity for a given amount of money invested. In the study of each item of cost, if it is found that an increase in first cost cannot produce some advantage it should, where possible, be avoided.

The economic requirements for a line are: low energy loss, reliability, the longest life, and the highest possible strength for the least cost per unit or per mile of line. Comparing the different kinds of line-supports (wood, iron, steel and reinforced-concrete) used, there seem to be many differences of opinion as to their life and depreciation values. As regards their life, differences may be due to incomplete or inaccurate base data; for instance, when considering the length of life of a wood pole, inaccurate or incomplete information may invoive such important questions as the actual diameter or circumference of the pole at the ground surface, the kind of wood (oak, red fir, &c.), the actual loading, factor of safety originally taken, and the actual span-length of line-supports. With regard to the span-length it should be noted that long spans usually give quite large savings in maintenance expenses and they help to reduce line interruptions because of the lesser number of insulators used on the line; moreover, the question of long spans introduces a condition where, generally speaking, the modern steel pole replaces the wood pole. This reference to steel poles does not include the tubular pole which is generally more costly and less efficient than a lattice pole of the modern type; also the wood pole referred to here does not mean the "A" or "H" frame, both of which are made up of more than one pole. By the use of a shorter span for a given line-support, or by a reduction of the load in some other way, an increased life of the line-support is secured. The mean range of life for poles, &c., is given in the table shown at the end of this article; this range of life is considered to be quite conservative. For wood poles the range of life is 13 to 25 years; this range is due to the many variables mentioned in various parts of the text matter. Obviously, the life may be much less than 13 years where ants are at work, and the life may be longer than 30 years for first-class hard wood poles properly treated, and favourably placed as regards foundation, but the range given here is considered to be a reliable mean.

A revision of the regulations for the transmission of electricity by overhead lines could scarcely have come at a better time than the present. On the other hand, to design for ½ inch ice-coating on conductors in this country is perhaps unreasonable. Of special interest are the new wire and cable and the conductor-supporting (structure and pole) loads, as also the modified factors of safety. As many of the Colonies and Dependencies follow quite closely British regulations and standards (more or less revised to suit respective local conditions) the revised code should prove more desirable to them in view of the fact that overhead lines are (and others may be) located in regions where a coating of ½ in. or more of ice can be expected, and where storms have very high wind velocity. That some of these Colonies do not have laws controlling such loads is well known, and that it has been the tendency to conform to the laws of Great Britain is also known, although the old code was for quite different climatic conditions to theirs. Actually, the new regulations are for this country (U.K.) only. In certain of the British Dominions there are considerable areas which occasionally have winds exceeding an actual velocity of 60 miles per hour (equivalent to 9.0 lb. per sq. ft. on the projected area of conductor only), and there are very large areas where conductors are subjected to accumulations varying anywhere up to about 2.0 in. of radial ice and sleet. No design is based on such a loading (2.0 in. of ice-coating), in fact, the worst condition of loading, which is used in the eastern part of Canada, is taken at 17 lb. per sq. ft. wind pressure, plus ½ in. ice on the conductors at a temperature of 0 deg. F. Load designs for railroad crossings are also severe; for instance, with regard to the conductors, the vertical load is taken as the dead weight plus ½ in. ice, and the transverse load is taken at 15 lb. per sq. ft. on the projected area; the temperature range is from −30 deg. F. to 120 deg. F., and the factor of safety is taken at 2.0. For the line-supports, the transverse load is very often taken at 15 lb. per sq. ft. of projected area, with a factor of safety of 3.0 for steel. The new regulations, which are based on the actual transverse wind loads upon the estimated projected areas of ice-coated conductors, may meet with rather poor acceptance all round. That part of the code showing modified factors of safety for line-conductors and line-conductor-supports may appeal perhaps more to this country than some of the Colonies as the new conditions may provide an easier basis for the Commissioners to facilitate a wider use of the single wood pole, which is the kind of pole material generally selected. In the articles to follow, several reasons are given to show why facilities, &c., can be extended by the Commissioners.

A line-support has to resist, in general, four different kinds of mechanical load, the combined forces of which determine the size of pole, or its members in tension or in compression in the case of a steel pole or tower. The cross-sectional area of the members may, therefore, be considered as being made up of four components, and, therefore, in estimating the cost of a steel structure, it is necessary to determine the different stresses to see how they influence the cost. The four kinds of mechanical load are:—

(1) Weight of the structure itself.

(2) Windage on the structure or pole. This is different according to the span length of line-supports.

(3) Vertical load due to the conductors, &c. This is taken as the total sum of the aggregate weight of conductors, insulators, cross-arms, ice and/or snow coating, telephone and/or earth wires, &c., and the downward pull of wires due to the difference in the heights of their points of support.

(4) Transverse load. This is applied at the top of the line-support by the power conductors and other wires. It consists of two components, one in the direction of the line due to the tension of the conductors and wires, the other in a transverse direction due to the windage and the side pull of conductors and wires.

With an increase in span of line supports and definite size of line conductors, the vertical and transverse loads will *increase;* also, for a definite span of line supports the vertical and transverse loads will *decrease* with a decrease in the size of line conductors*, and *vice-versa* for each of the two cases.

* ELECTRICAL REVIEW, April 25th, 1924, page 646 (see [2] and [4] of column on right; [2] should read *increase* and not decrease.

For normal working conditions, and for lines without tangents in them or without any considerable change of direction, line-supports are designed and the span lengths made so as to withstand (for the specified factors of safety) such loads and stresses as: wind pressure on the line-support itself; the combined stresses produced by the weight of the line-support; and the specified transverse conductor loadings. The worst stresses on a span occur when it has its greatest loading, minimum temperature and maximum wind velocity at right angles to the line. In general, lines do not always work under normal conditions, nor do they generally have exactly straight runs throughout their length, and, therefore, stronger supports are required at appropriate intervals or/and at angles in the line. They must be designed to withstand (in addition to the vertical and transverse loads) a longitudinal load caused by the breaking of one or more conductors depending on the system, number of circuits, location, size of conductors, span, &c. The worst stresses are those due to the breaking of conductors accompanied at the same time by ice-coating and a high wind velocity at right angles to the line. Opinions differ as to what should be taken as a basis for the unbalanced tension under abnormal conditions to be met with in practice for the different grades of line construction and for lines operating under different climatic conditions and in different localities, and for vastly different services, some small and others of great magnitude transmitting power in great bulk at very high voltage. Obviously, one rule cannot apply to all lines. As a rough guide we may assume: (*a*) one broken conductor for line-supports carrying two or three line-conductors; (*b*) two broken conductors for line-supports carrying four to six line-conductors; (*c*) three broken conductors for line-supports carrying seven to nine line-conductors. Each of these cases will depend on the loading conditions, the conductor arrangement, type of line-support, &c. This rule may also be put in another way by allowing one stronger line-support or/and more stay wires for every so many span-lengths depending on the conditions such as those mentioned here; in fact semi-anchor as well as anchor line supports may be used.

The overhead line is a very flexible structure and, although angles in the line are objectionable, they add to its flexibility and help to relieve the stress in the line, which is a condition particularly desirable during the winter months when the temperatures are low and the resulting stresses increased to a very high pitch. Where conductors are not rigidly fastened to the insulators or otherwise held at each line-support, the heaviest load on the line-support may, more likely, be that caused by the longitudinal stress of all the line-conductors. Far too little importance is attached to the value of a tie-wire or clamp for rigidly holding the conductor at the insulator. It is important to bind the wire on so tight and so well that it should not rub the glaze away. Once the glaze is cut away, the rough place may cut the wire through. Every so often it is advisable to renew tie-wires and at the same time re-sag the conductors. When conductors are rigidly secured in this way to the line-support, no longitudinal load need ordinarily be estimated for intermediate line-supports, as rigidly held conductors at the insulators will usually secure sufficient longitudinal rigidity. If the mechanical strength of each insulator and pin is not made use of in this way the stress must be carried to the ground in some other way, which is by stays and/or by stronger line-supports placed at appropriate intervals along the line and used for anchoring or "dead-ending" purposes, and therefore, larger, stronger, or more insulators must be used at these anchor points, which practice may prove a hazard due to the lack of proper tie-wires at each line support. Anchor or semi-anchor line supports used for meeting these requirements may be head, back and/or side stayed, depending on conditions. In those cases where a self-supporting frame or structure is not objectionable (as would usually happen in the case of a cross-country line) it should be used in preference to stay wires or struts, but it is the more expensive way of giving additional strength.

The total resultant load strength of a line-support is that of the breaking stress (or ultimate strength) divided by the minimum allowable factor of safety; the latter is given in the new regulations as 2.5 for iron and steel, and 3.5 for wood and reinforced-concrete. The factor of safety against overturning, which defines more or less the quality of foundation, is given as 2.5. Regarding wires, for the best grade of line construction, workmanship, and ordinary conditions met with in countries like this, it is not recognised that a factor of safety of 2.0 is quite sufficient to provide for practically all unknown conditions and defects which may exist due to the character of materials, the common faults of stringing in the field, and so forth. Experience in large areas, subjected to very severe conditions, proves that failures of conductors which have been strung so as to have a factor of safety of 2.0 (based upon the breaking or ultimate strength of the conductor) are practically unknown. The factor of safety of the insulator and pin may also be taken at 2.0*. Stay wires should be used oftener than they are; a stay should be designed so as to have sufficient strength to withstand the specified maximum stress with a factor of safety of not less than 3.0; the old regulation specified 6.0.

The old regulations specifying a factor of safety of 10.0 for wood and 5.0 for wires was usually understood to have made overhead line construction more costly than it might have been and so kept back overhead line development, or it jeopardised the success of small undertakings in villages or small towns where a low capital cost was of prime importance. The factor of safety of 10.0 was also estimated to have restricted the use of the single wood pole, which is a very important matter for this country at the present time. However, in the ordinary way, the new regulations do not allow of lower cost where $\frac{1}{2}$ in. ice coating is specified.

A single pole of any material is cheaper, looks better, can be solidly set or buried into the ground, takes up less space, allows a shorter cross-arm to be used, and may permit of a less spacing of the line-conductors than the "A" frame, and most other forms of structures which cost more, look ugly, take up a lot of space, require longer cross-arms, and may place a limit on the minimum spacing of line-conductors for certain line voltages or, in other words (due to the increased spacing of the conductors), tend to cause an increase in the voltage regulation, and can, generally speaking, only be adopted for cross-country lines. The use of "A" frames and other forms of wood structures for line-supports will permit the use of a longer span-length or a greater loading, but, as compared with a pole of other material such as steel, and for equal span or loading, the relative cost of the wood frame would be increased and the life reduced; the reduction in life is due to the increased total circumferential surface of the wood subjected to rot, and due to the uncertainty of treatment, and exact quality of any particular wood pole. The life of a wood pole or structure depends upon its original strength, the thickness, kind of material, spacing of the supports, and/or loading, and the factor of safety used. A good additional rule for safety is to head, back and/or side-stay a line at about every fifth to tenth pole, depending on the straightness of line, the location, the span length, temperature range and importance of the line.

(To be continued.)

Birmingham Electric Club Programme.—The opening meeting of this club for the new session takes place to-night at the Grand Hotel, Colmore Row, with a lecture on "Electric Motors for Special Purposes," by Mr. W. N. Y. King. Other events in the half-session programme just issued are:—October 24th, "Heavy Oil Engines for the Generation of Electricity," by Mr. C. W. Chapman; November 28th, "Thermionic Valves," by Mr. G. A. Percival.

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*Both should preferably withstand a stress equal to the elastic limit of the conductor when exerted in any direction in a plane perpendicular to the axis of the pin.

Radio Interference Elimination—I.

By R. H. WHITE, M.I.E.E., M.I.R.E.

THE greatest difficulty which the wireless enthusiast has to overcome is "jamming," or interference from unwanted stations. The following three articles describe methods of overcoming this.

The first article deals with methods which may be employed without altering any connections in the existing receiver, as all tuned circuits, aerials, &c., are in addition to the ordinary tuned circuits within the receiver.

In the second article finer methods of rejection of the unwanted signals are described. These methods could be successfully applied by the majority of experimenters to an existing receiver set without altering the actual receiver. The construction of a supersonic heterodyne set calls for some considerable manual and technical skill, but it is a set which is so extraordinarily sensitive that its construction is very well worth while.

The last article, which deals with filter circuits, is for the experimenter and constructor who has built, or is going to build, a wireless valve receiver.

Improvements for Wireless Receivers.

In the reception of wireless telegraphy or telephony, the elimination of unwanted signals plays a very important part.

In an area congested by a multitude of wireless stations, many of which may be movable, such as ship stations, total elimination is sometimes impossible, but interference or "jamming" may be very considerably reduced by the careful application of two or more known systems used simultaneously for the protection of one receiver.

The principal methods which are employed to-day for this purpose are:—

1.—Tuning	1st article
2.—Balancing aerials	do.
3.—Acceptor and rejector circuits ...	2nd article
4.—Supersonic heterodyne	do.
5.—Filter circuits	3rd article

When telegraphic reception only is being undertaken, the rejection of unwanted signals is much easier than in the case of telephony, for in the former case note tuning and note filtering may be employed. This is a great advantage, as it means that only notes of one "pitch" or frequency need be admitted to the telephones, and that therefore stations only employing the same note as the one which it is intended to receive will be heard, and this only if they pass through the outer lines of defence which are set out above.

In telephony, however, it is necessary to receive all the audible notes of the musical scale. It is, therefore, not possible to use this protection, whilst at the same time some of the other tuning arrangements, enumerated 1 to 5 in the list above, cannot be employed to their fullest extent, as if this were done they would lead to a curtailment of some of the musical scale, or at all events to distortion.

Tuning.

When a receiver is "tuned" to the wave which it is desired to receive, it means that the values of the inductance and capacity of its circuits have been adjusted so that the time constant of the receiver circuits is the same as that of the transmitter. Hence, if the receiver is tuned to a wave length of 300 metres, which is equal to 1,000,000 cycles per second, then in the transmitter aerial the current will oscillate 1,000,000 times a second, whilst if the receiver is allowed to oscillate the current in it will also oscillate 1,000,000 times a second, so that the currents in the transmitting aerial and in the receiving circuit are both swinging, like two clock pendulums, in absolute synchronism. Thus, as each "push" of current comes down the receiving aerial, it arrives exactly at the right moment to give its push to the oscillating current in the receiver.

In a very small fraction of time the repeated pushes have built up the swing of the current in the receiver circuit to a maximum.

During this building up, at each successive push, the voltage across the condenser, which forms a part of every oscillating circuit, becomes larger and larger, till it finally reaches a value which may be many times larger than that of the supply voltage or "push."

The sharpness of the tuning depends on the decrement of the transmitted waves, and on the decrement of the receiving circuit, which in its turn depends upon the resistance of the latter.

The resistance of the receiver circuit in general consists of two parts: first, the resistance of the coil, which will depend on the thickness of the wire, the insulation of the wire, and the material of the former on which it is wound; and secondly, the resistance of the condenser, for, whilst there may be no losses in a condenser when it is subjected to a direct-current difference of potential, yet the same condenser may have considerable losses when tested with current at radio frequency. It is because of their low losses that air condensers are now so generally used in wireless receivers.

Low decrements of the receiver circuits are, therefore, obtained by having all circuits of low resistance. When this condition is met, and provided loose couplings are also employed, fine tuning can be obtained, and this is the first step towards the elimination of interference.

Balancing Aerials.

When a receiver is connected to a simple vertical wire, it will receive signals equally well from any direction, provided that there is no local shielding, such as high hills or houses close to the aerial.

The simple vertical wire aerial is, therefore, the worst type which can be used if it is desired to eliminate unwanted signals before they pass through the receiving system.

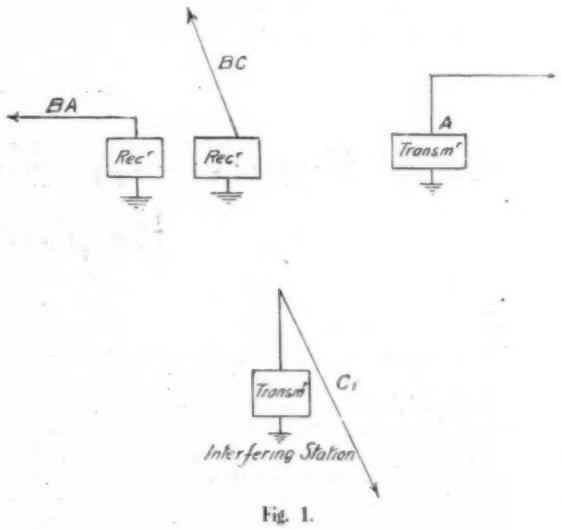


Fig. 1.

It is well known that an aerial consisting of a short vertical wire, with a long extended top which is horizontal, has marked directional properties. Such an aerial may well consist of a wire 9/10ths of which is horizontal and 1/10th of which is vertical. If this wire is bent away from the sending station (as in fig. 1) it will receive stronger signals from the station A than if the aerial BA is in any other

direction except vertical, whilst at the same time the aerial BA will be an inefficient aerial for reception from any other jamming station, such as C, fig. 1.

If the "jamming" station C is a fixed one it may be very largely eliminated by erecting a second aerial at B, also of the directional type, and bent in a direction away from C, as the aerial BC, fig. 1.

Now, suppose that two separate receivers, which were identical, were connected one to the aerial BC, and the other to the aerial BA.

When the station A was sending, strong signals from it would be received in the receiver connected to aerial BA, whilst weak signals would be received in the receiver used in conjunction with BC.

When station C started to transmit the reverse would be the case—strong signals would be received in the BC receiver, whilst those in the BA receiver would be much weaker.

Now if both station A and station B send at the same time, the station A will come through strongly in the BA receiver, whilst station C will also be heard at the same

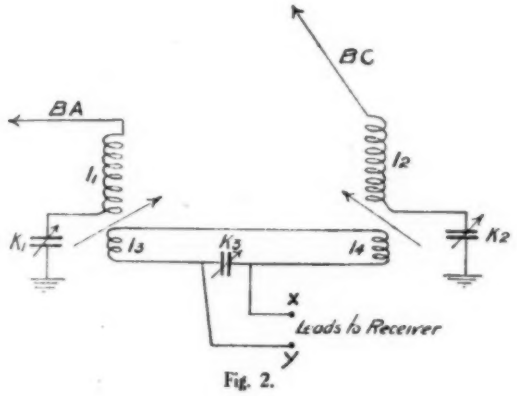


Fig. 2.

time, but its signals will be weaker than those from A. In the receiver connected to the aerial BC the reverse will be the case.

If now in place of two receivers, one receiver is used, and if it is coupled to both aerials at once, in a special manner as shown in fig. 2, then it should be, and is, possible to cut out the jamming station altogether, and this elimination of the jamming takes place outside the actual receiver, so that an existing receiver may be used, as all the balancing circuits are external to the receiver proper.

The apparatus consists of (fig. 2):—Two aerial tuning inductances, l_1 and l_2, connected in series with the aerials BA and BC. These two coils should be wound in opposite directions, or other arrangements made for correct phasing, for a reason which will be apparent later on. Between each A.T.I. and earth is a tuning condenser K_1 and K_2.

An intermediate circuit l_3, l_4, K_3, having two coils l_3 and l_4, equal to one another, and a condenser K_3, which is connected to both, and which will tune the circuit l_3, K_3, l_4 to the wave which it is desired to receive, is made up. This circuit is so arranged that the coupling between l_1 and l_3, as well as that between l_2 and l_4, is variable.

In this circuit l_3, K_3, l_4, the effects of the currents passing down both aerials will be combined.

It is important that there should be no direct coupling between l_1 and l_2, so that these two coils are better placed far apart from one another.

Now if the jamming station C is working, its signals are received on both aerials BA and BC. They therefore affect the circuit l_3, K_3, l_4, which is loosely coupled to both aerials, but these effects are in opposition to one another. By suitable tuning and coupling they may be so adjusted that they neutralise one another, and no signals from C are heard in a receiver connected to X, Y (fig. 2).

If station A starts to send, it will also produce currents in opposition to one another, but the current in BA is stronger than that in BC, for BA is directionally favourable to A. The currents from BC will therefore only cancel in part those from BA. There will be something left over from BA—this is the signal which is wanted, and it should be quite free from any interference from station C.

With good long low directional aerials this system gives excellent results; even if C the jamming station is near to the receiver, and normally its signals are many times the strength of those from A, C can be cut out altogether.

In place of horizontal directional aerials, frame aerials may be used, but again great care must be taken with the couplings. This arrangement permits the cutting out of various jamming stations, as the frame aerial may be rotated to point in the desired direction.

If the jamming signals are very strong, it is an advantage to have an adjustable resistance in series with BC, l_2, K_2.

Power Factor—A Simple, Non-Technical Explanation.

By A. P.

NOWADAYS the question of power factor rebates and penalties is often to the fore, and as this is a matter which has frequently to be discussed with the principal of a firm of consumers, who possibly has not the slightest idea what power factor is, engineers have had difficulty in finding a simple explanation such as can be understood by a non-technical man.

The writer, being frequently up against this difficulty and having as yet seen no simple analogy, has hit upon a simple explanation, which he has used on several occasions with success.

Take the case of a railway company charging a rate per ton for the carriage of goods. A customer wishes to send 100 tons of machinery packed in cases, and the railway company provides a train of covered wagons which will comfortably pack and carry 100 tons, if the cases are just the right size with no waste space, hauled by a locomotive which will be working under the most economical conditions when drawing this 100-ton load. If the customer in his next shipment chanced to pick up a lot of cases at a cheap price which were really too large for his requirements, but in order to use them up packed his machinery in them and sent them along, the railway company having provided the same train and locomotive, it might be found that with the larger cases only 60 tons of machinery could be accommodated in the same covered wagons. The railway company would, therefore, only be able to charge for 60 tons, and a larger locomotive than necessary would have been provided, costing more, but not bringing in revenue such as it would if pulling its proper load. (The extra weight of the large cases is regarded as negligible.) The company would, therefore, be losing the revenue on 40 tons which it would have been able to carry with the same

train and locomotive, and would consequently be justified in penalising the customer for taking up valuable space, or in offering a rebate to tempt him to reduce the size of his cases and so enable it to carry another 40 tons of revenue-producing goods with the same train and locomotive.

The argument applies in the same way to a supply company providing generators and cables for carrying, say, 100 kW of revenue-producing power. A customer installs motors which, like the large packing cases, reduce the revenue-producing carrying capacity of the generators and cables to 60 kW. The supply company is justified in penalising him as in the case of the larger packing cases, which the consignor can reduce, just as the power consumer can reduce the waste "space" occupied by his wattless current. By using suitable means the consumer can enable the power company to utilise this waste capacity for a revenue-producing power load of anything up to 40 kW, just as the railway company, by insisting on the packing cases being reduced, can increase its revenue-producing load by 40 tons, the gain depending in one case on the amount of power-factor correction adopted, and in the other on the reduction in the size of cases, both of which again depend on the inducements offered or the penalties inflicted.

The writer at first considered a storage warehouse of a certain capacity charging a rate per ton, in which case the revenue would be reduced by large packing cases; but the introduction of the locomotive makes the reasoning more convincing, as not only revenue-producing space in cables and generators is reduced by bad power factor, but also the prime mover is not working up to its limit, which means that with bad power factor capital has been laid out with no adequate return for the larger prime mover.

The Electric Carnival at the British Empire Exhibition.

On Wednesday last week the Carnival organised by exhibitors in the Palace of Engineering was held, and proved very successful, in spite of somewhat adverse weather which damped those who took part in the procession, but did not appear to have any effect on their spirits. The principal features of the procession of gaily decorated vehicles and walking models of electrical appliances, which started from the Faraday Gate and passed through the main avenues in the Exhibition grounds, were an elephant, on which rode "Old Bill"; illuminated cars provided by the Electrical Development Association, the General Electric Co., Ltd., the Marconiphone Co., Ltd., and Messrs. Alfred Graham & Co., Ltd.; various "Railodoks"; and a number of men in fancy dress. The prizes (distributed by Sir Lawrence and Lady Weaver) went as follows:—

For the best electrical display: The "Miss Sunshine" car of the G.E.C.

The first ladies' prize: To "Miss Electricity," represented by Miss S. P. Gillott.

The second ladies' prize: Messrs. Siemens's representation of their "Crystal Gazer" poster: "I see a brilliant future."

The first gentlemen's prize: Mr. L. B. Atkinson, as "The Roman Warrior" (C.M.A. trade mark).

The second gentlemen's prize: Messrs. Venner Time Switches, who showed "Father Time."

The G.E.C. car was lent by the Railodok Company, and the "Osram baby" was represented by Miss E. Evans; the vehicle was draped in blue and trimmed with multi-coloured streamers, and the sides of the car were decorated with Osram colour-sprayed lamps. In the interior of the car 56 80-volt, 20-watt "White Osrams" and flame-tinted colour-sprayed lamps were used.

The E.D.A. car, on which rode "Miss Electricity" in her glory, was designed to illustrate the many domestic uses of electricity, and presented a brilliant appearance. Miss Davis, of the Siemens & English Electric Lamp Co., Ltd., who represented the "Crystal Gazer," rode in the Siemens decorated car, which also was lent by the Railodok Company, and was seated under a canopy at a table with the lighted Siemens white-sprayed enamelled lamp before her.

Dancing followed in the large hall, and was kept up until closing time, many well-known members of the electrical industry taking part in the proceedings, which included a number of competitions. The attendance numbered about 700.

Legal.

The Shops Closing Act.

A wireless apparatus retailer (A. M. Gibson), carrying on business at Plymouth, was summoned at the Plymouth Police Court last week for keeping his shop open after hours on the night of September 2nd. The police evidence showed that when defendant was spoken to for selling goods at 8.30 p.m. he suggested that there were no restrictions on wireless shops, and pointed out that they would be found open in other parts of the town. Mr. Gibson, in pleading guilty, said many people could not buy their wireless sets or parts during the day, because they were engaged at business, and if wireless shops had to close during the only hours in which it was possible to give demonstrations it would be a great hardship on the trade. The wireless industry was a new one and did not exist when the Shops Act was passed. The Chairman of the magistrates, however, remarked that it was quite clear that under the Shops Act of 1920 wireless shops must close at 8. Apparently defendant had acted under a misapprehension. Defendant gave an undertaking to close his business in future at the proper hour, and the case was accordingly dismissed.

Rating a Private Lighting Installation.

At the Stirling Valuation Appeal Court, on September 16th, an occupier appealed for a reduction of the valuation placed on his property on the ground that the Assessor had charged him for an electrical installation, which, he stated, had never in his experience been assessed as heritable property.

The Assessor pointed out that the electricity was generated in the house, and the apparatus belonged to the proprietor. He submitted that the electric light was therefore part of the heritage.

The Court dismissed the appeal.

Reviews.

Electrical Vibration Instruments. By A. E. Kennelly. Pp. xii+450; figs. 214. New York: Macmillan Co. Price 30s. net.

This is a first-class book for engineers dealing with telephone instruments, and it will also be of assistance to those dealing with the mathematical problems of vibrations from unbalanced rotating loads. The author (in the first 195 pages) deals exhaustively with the behaviour of telephone receiver diaphragms under various conditions, so that anyone seeking for explanations of motional impedance, of load, and frequency of exciting current, stiffness coefficients, amplitude measurers, admittance damping constants, sharpness or bluntness of resonance, &c., will find the answer here. After dealing with receivers, the author discusses oscillographs, and oscillographmeters, vibration galvanometers, and the humming telephone, in 107 pages. These chapters contain a good deal of mathematics, though of a relatively simple type. Then follow 103 pages of appendices, giving the fuller and more advanced mathematical treatment of the various theorems. The bibliography at the end contains 95 references.

Along with the discussion upon the qualities of receivers and instruments there are fairly detailed descriptions of how to take the actual measurements, and a number of detailed illustrations. The treatment of the whole subject is dealt with from the standpoint of vectors, and the author shows clearly the similarity of the electrical equations for various conditions, to the equations for mechanical systems of vibration, of either rectilinear or rotational type. This is where the book may be useful to those dealing with mechanical vibration problems.

Technical Costs and Estimates. By Andrew Miller. Pp. xii+102; 43 specimen and explanatory forms. London: Gee & Co. Price 10s. 6d. net.

The author attempts a large task in his endeavour to condense within some hundred pages a detailed description of the essentials of a costing system applicable to many different technical manufactures.

It almost naturally follows that the book he has produced demands the reader's closest attention in order that the principles and explanations may be digested. The book is avowedly written as a guide to students, as well as those of riper experience, and a word of warning is therefore necessary. "Do not be overcome by the number of sub-headings and the capital letters which so frequently occur, or by the insertion of paragraphs, the purport of which is not immediately apparent." Industry will be rewarded, for we have here a most able treatise on costing and estimating.

Several major points of importance will impress themselves upon the reader's notice. (1) The author very rightly stresses the importance of the cost accountant's acquiring a sound technical knowledge of the manufacturing processes which he has to cost. Accountancy, mathematics, some parts of the law, economics, and other subjects have their place in the

training of the cost accountant, but without that technical knowledge, his ability to meet and tackle the varied problems that must arise in his work will be insignificant.

(2) The cost accountant, if he is successfully to perform his duties, must influence practically every phase and section of the business in which he is working. Organising ability is, without doubt, one of his most necessary qualifications. In order that correct records of cost information may be obtained quickly, and in order that results may be tabulated, analysed, and presented before they are dead, first-class organisation is required, not only in the cost department, but in all parts of the executive and of the administration of the business.

(3) The author states in more than one place that the real object of cost accounting is to obtain reliable data for estimating purposes. To this we cannot altogether subscribe; as a medium for controlling the activities of manufacture, selling, and administration (to which function some reference is made in Chapter XI), cost accounting provides what is often regarded as a more important feature than that of supplying estimating data.

(4) A costing system must be designed to meet the needs of all functions of a business—manufacturing, estimating, purchasing, production planning, selling, designing, &c. A cost accountant does not collect information for the purpose of filling musty files and ledgers; the information and results which he publishes are a vital factor in the running of the whole business.

(5) Every entry in the cost accounts must be checked if accuracy is to be ensured, but certain methods suggested and some of the statements in this book will not pass unchallenged. For instance, the author states that the cost of replacing defective manufactures should be charged to the "prime cost," though the ultimate effect "will not be much different usually from that of averaging such replace costs to all cost accounts as oncost." Surely that is a trap for the unwary! Again, it is stated, on page 4, that "the working expenses for manufacturing and selling is generally from 50 per cent. to 100 per cent. of the production labour cost." In this country, at all events, it is the practice for some firms to charge certain items as "production labour" which other firms include amongst "oncost," so that no true comparisons can be drawn between businesses from their ratio of "oncost" to "production labour." One business, whose ratio is 125 per cent., may quite well be more economically controlled than another in the same trade whose ratio is 75 per cent., merely because of their different methods of costing.

We feel that such points as the inclusion of interest on capital in the costs, and the treatment of the cost of idle capacity deserve more than a passing reference from the author.

Some time ago the Institute of Cost and Works Accountants issued what is taken to be an official survey of terminology, laying down certain terms, the general adoption of which would greatly facilitate the perusing of treatises on cost accountancy. Such terms as "oncost" have no place in their survey of terminology, and we deplore the fact that the author has not helped to ameliorate "terminological difficulty" by a more studied application of the Institute's valuable contribution to its solution.

Particular attention should be paid to the chapters on the connection between the cost and financial accounts, especially to the table on page 79, and to the consideration of purchase and replacement costs of material on page 30 *et seq.* The author is to be congratulated on the convenient plan adopted of arranging the forms, charts, and graphs at the end of the book so that they may easily be studied whenever reference is made to them in the text.

The volume bears evidence of the sound experience of the author, and can be confidently recommended, not only to students, but to all who have the foresight to make use of cost accountancy as an instrument which will accurately and speedily portray the workings of their manufacturing, selling, and administrative activities.

Electric Wiring Diagrams for Motor Vehicles. By M. A. CODD, F.Ph.S. Pp. 92. Figs. 88. London: E. & F. N. Spon, Ltd. Price 3s. 6d. net.

This "book" consists of an introduction of two pages and 87 pages of diagrams. The diagrams are a collection of wiring charts issued by the electrical manufacturing firms and are here reproduced in a handy size (10 in. by 6¾ in.) and in a book form so that they may be easily referred to when required.

All the well-known electrical systems are included and (with the important exception of the Rolls-Royce) most cars seem to be dealt with in the 89 diagrams which are given. The advice in the short introduction is excellent and very clearly set out in small paragraphs with wide inter-spacing which makes assimilation of knowledge so much easier to the average human brain.

The wiring diagrams as collected in this book serve to call attention once more to a point which the present writer has mentioned very often, namely, that there should be two diagrams for every system used on cars, one an ordinary wiring chart for the technical man and the other a pictorial diagram for the layman. To the latter a technical diagram is so much Hebrew and to the former a proper technical diagram is essential in order to understand the system. No combined diagram is any use and most of them are very confusing.

The idea of two diagrams was first carried out by the Delco-Remy Co., and although they are not shown in this way in the present book several of their excellent technical diagrams are given.

The two-diagram idea is carried out by the Lucas Co. and by the Rotax Co., one especially good example by the latter firm being the diagrams on pp. 58-59, referring to the B.S.A. 10 h.p. car. A fairly good wiring diagram is shown of the connections of a standard magneto on p. 60.

It is important that a reference book of this kind should have a good index and this is well carried out, showing both the names of the cars dealt with and the different electrical systems. The book well fulfils its purpose and should be especially useful to garages and repair shops.

F. H. HUTTON.

Business Notes.

Bankruptcy Proceedings.—LEONARD SPREADBOROUGH, trading as L. Spreadborough & Co., lately carrying on business at 539, High Road, Leytonstone.—The first meeting of creditors was held at Bankruptcy Buildings, W.C., on September 12th. Prior to 1902 debtor was in employment as a journeyman electrician. He then started to take in electrical work at his private address on his own account. About 1912 he transferred his business to 539, High Road, Leytonstone, where he carried on until early in 1922. His business was then falling off, and with a view to improvement he took more central premises at 46, Rathbone Place, Oxford Street, W. At Christmas, 1922, the tenants received notice to quit. He then took three rooms at 14, Frith Street, Soho, where he traded until November, 1923. Trade had been falling off for some months and, being pressed by creditors, he called them together and submitted a statement of affairs showing liabilities of about £350 and no assets. Through a friend he made an offer of 5s. in the £, which was refused. Since then he had done no business and was being supported by his two sons. He attributed his failure to falling off of trade and working under cost owing to keen competition.

The estate remains in the hands of the Official Receiver.

WALLIS & WARD, 29a, Leslie Park Road, East Croydon, electrical engineers.—Receiving order made September 11th on a creditor's petition.

A. G. INRIG, 46, White Post Lane, Victoria Park, electrical engineer, trading as the Globe Electrical Co.—Last day for receiving proofs for dividend, October 3rd. Trustee, Mr. F. T. Garton, Official Receiver, Carey Street, W.C.2.

S. G. WILKINSON, 25, Havelock Road, Harrow, carrying on business as an electrician at 16, High Road, Wembley.—Last day for receiving proofs for dividend, October 1st. Trustee, Mr. T. Gourlay, 29, Russell Square, W.C.1.

H. PARR, 2, Strawberry Dale Square, and 1, Back James Street, Harrogate, electrician.—First and final dividend of 3s. 10d. in the pound, payable September 30th at 112, King's Road, Harrogate.

F. S. BOWEN, electrical engineer, trading at Manchester as the Manchester Electrical Maintenance Co., and F. Bowen and Co.—Trustee, Mr. R. R. Smethurst, 21, Spring Gardens, Manchester, appointed September 16th.

J. COWAN, merchant of electrical appliances, trading as Cowan & Fox, at 35, Dickinson Street, Manchester.—Trustee, Mr. J. Sykes, 30, Belgrave Place, Stalybridge, appointed September 15th.

F. J. PEARSE, 204, Brixton Hill, S.W., maker of electric lighting fittings.—The receiving order, made on July 24th, was rescinded on September 4th, debts having been paid in full.

Company Liquidations.—ANDCOLE & TURNER, LTD., electrical engineers, 64, Victoria Street, Westminster, S.W.—Meetings of creditors and shareholders under a compulsory winding up order made against this company were held on September 16th at the Board of Trade Offices, 33, Carey Street, W.C. The order was obtained on the petition of the Midland Electrical Manufacturing Co., Ltd., of Birmingham, who claimed to be creditors for £169. A statement of the company's affairs showed gross liabilities £5,458, of which £2,968 was due to unsecured creditors and £2,490 to debenture holders. The assets, consisting largely of book debts, were valued by the directors at £3,184. The deficiency, as regards creditors, was estimated at £2,273 and, taking shareholders into account, a total deficiency of £3,093 was disclosed.

The Official Receiver reported that the company was registered in June, 1914, to carry on business as electrical engi-

neers. The promoters were Messrs. H. W. Anderton, H. Coleman, and W. F. Turner, who had previously been in partnership in the electrical business. The company's sales until 1919 averaged about £3,000 a year, and a small net profit was shown over the whole of that period. The sales afterwards increased and amounted in 1923 to £19,390. A net loss of £1,226 was disclosed for that year. In April, 1924, a receiver for debenture holders was appointed, and his realisations have proved insufficient to meet the claims of the debenture holders. The failure of the company was attributed to the trade depression which set in early in 1922 and to insufficient capital.

The liquidation was left in the hands of the Official Receiver.

Creditors include the following, and a large number of others for sums of less than £20 :—

	£		£
Ahlman (London), Ltd.	74	Kabelfabrik und Drappindustrie Aktien Gesellschaft, Vienna ...	36
British Thomson-Houston Co., Ltd.	84	Kerson's Manufacturing Co., Ltd.	94
Bernard & Co., Ltd.	23	S. G. Leach & Co., Ltd. ...	23
Charmlyn Electric Co., Ltd. ...	25	Marshall Electrical Co., Ltd. ...	36
Credenda Conduits, Ltd. ...	34	Midland Electrical Manufacturing Co., Ltd.	144
Cable Accessories Co., Ltd. ...	42	Metropolitan-Vickers Electrical Co., Ltd.	68
J. A. Crabtree & Co., Ltd. ...	27	New Gutta Percha Co., Ltd. ...	36
Castellina Co., Ltd.	30	Pelican Electric, Ltd.	80
Craigpark Electric Cable Co., Ltd.	20	Reeves & Co.	84
Cryselco, Ltd.	33	Stella Conduits, Ltd.	118
Collis & Brown	20	Standard Gas Fittings Co., Ltd.	22
Davies, Kent & Stewart, Ltd.	45	H. W. Sullivan, Ltd.	32
De Gares & Allen, Ltd.	38	Walsall Hardware Manufacturing Co., Ltd.	29
Forward Electric Co., Ltd. ...	26	Wholesale Fittings Co., Ltd. ...	47
General Accessories Co., Ltd. ...	27	H. A. Wootton & Co.	77
General Electric Co., Ltd. ...	121	J. Warwick & Co., Ltd. ...	29
Grimston, Pritchard & Plutte, Ltd.	36	Consolidated London Properties Co., Ltd.	118
General Cable Manufacturing Co., Ltd.	308	W. L. Turner	24
Hagger & Daniels, Ltd. ...	37		
Holophane, Ltd.	21		

METROPOLITAN ELECTRIC WIRE CO., LTD., 48, Bayham Place, Camden Town, N.W.—The report of Mr. E. T. A. Phillips, Official Receiver and liquidator of this company, has been issued to the creditors and shareholders. The accounts filed under the liquidation show liabilities of £3,160, against assets valued at £792, and a total deficiency of £4,169 as regards contributories. The company was registered as a private company in January, 1923, with a nominal capital of £500, and was formed to carry on business as manufacturers of and dealers in electric wire and accessories used in the manufacture of electrical appliances. In the following May the nominal capital was increased to £5,000. The failure of the company is attributed by Mr. A. E. Eats, one of the promoters and directors, to insufficient working capital and expensive experimental work which proved abortive, but the Official Receiver is of opinion that the company's affairs have been grossly mismanaged.

KELLY & TARSHIS, LTD., electrical engineers, 5, High Street, Shoreditch, London, E.—Under the compulsory winding up order made against this company in January last, Mr. E. T. A. Phillips, Official Receiver, has issued to the creditors and shareholders a summary of the company's statement of affairs. The liabilities are stated at £4,327, of which £700 is due to debenture holders and £3,627 to unsecured creditors. All the assets, valued at £230, are required to meet in part the claims of the debenture holders. With regard to shareholders a deficiency of £502 is disclosed, making a total deficiency of £4,598. The Official Receiver, in his report, states that the company was formed in March, 1923, to acquire the business of electrical engineers carried on by Messrs. Kelly & Tarshis, who were appointed permanent directors of the company. Mr. A. A. Gould, who used the name of A. Alexander, and who registered the company, afterwards took an active part in the business. The failure of the company is attributed by its officials to constant disputes between the directors, to keen competition, lack of capital, and the rapidity with which wireless instruments and parts became obsolete owing to improvements. In the opinion of the Official Receiver, the failure is due to lack of capital and to gross mismanagement on the part of the directors, who appear to have allowed themselves to be controlled by Mr. Gould throughout. The Official Receiver adds that he has sold the assets of the company for £175. The debentures, which were issued to Mr. Gould, are invalid to the amount of £537, as they were issued within three months of the winding up petition. The Official Receiver is acting as liquidator.

WIRELESS MANUFACTURERS, LTD.—Winding up voluntarily. Liquidator, Mr. F. Morse, 1 and 2, Great Winchester Street, E.C.2. A meeting of the creditors will be held at the liquidator's offices on September 30th.

LINCOLNSHIRE MOTOR & ELECTRIC TRACTION CO., LTD.—A meeting of the creditors of this company is to be held to-day (Friday) at the Ship Hotel, Grimsby.

RADYR ELECTRIC CO., LTD.—A general meeting of the company will be held on October 17th at Plymouth Chambers, Westgate Street, Cardiff, to hear an account of the winding up from the liquidator.

CLAYTON & JAMES, LTD.—Winding up voluntarily. Liquidator, Mr. A. W. Goodfellow, C.A., 48, Gresham Street, E.C.

Private Arrangements.—LUKE RADFORD, trading as L. Radford & Co., electrical engineers, 14-15, Station Buildings, Altrincham.—A meeting of creditors was held recently, when a statement of affairs was submitted which disclosed liabilities of £493, of which £456 was due to the trade. The net assets were £141, or a deficiency of £352. It was reported that proper books of account had not been kept, and no deficiency account was available. The debtor's drawings were stated to have been £6 per week, including expenses. His wife had taken charge of the offices, and he himself had supervised the contract work. He had no capital to start with. It was reported that the debtor had latterly been engaged on fitting up houses under housing schemes, and at present had a contract to fit 30 houses, on five of which work had been commenced. It was calculated that there would be a profit on that contract, and there was a possibility of the five houses being completed. It was pointed out, however, that if the remaining 25 houses were not completed there would arise the question of breach of contract. The matter was discussed at some length, and it was eventually decided that the estate should be dealt with under a deed of assignment.

Dissolution of Partnership.—VALVELESS AMPLIFIER CO.—Messrs. C. F. Adolph, W. Levy, and H. Goodwin have dissolved partnership. Messrs. Levy and Goodwin will attend to debts, and continue the business under the same style.

Trade Announcements.—It is announced that while existing contracts for British-built Riley stokers will be duly completed by Charles Erith & Co., of Palace Chambers, S.W.1, all future contracts will be made by the RILEY STOKER CO., LTD., which has acquired sole rights for British manufacture and sale of the Riley, Harrington, Jones and Murphy stokers corresponding to those made in America by the Sanford Riley Stoker Co. and in France by the Fama Company.

THE SYNCHRONOME CO., LTD., is opening a West End office at 19, Caxton House, Westminster, London, S.W.1, to which address its Contracts Department will be removed on September 29th.

The address of THE BRITISH THOMSON-HOUSTON CO.'s Glasgow office has this week been changed to 53, Pitt Street (opposite Waterloo Street), instead of 91, Wellington Street.

MESSRS. FARQUHAR & HEYS, electrical engineers, have completed the reconstruction of business premises in Limbrick, Blackburn, and these have now been opened for the display of electrical apparatus and wireless accessories.

MR. THOMAS HAYDOCK, electrician, has opened a new electrical store in Shear Brow, Blackburn.

MESSRS. AUTOMATIC & ELECTRIC FURNACES, LTD., announce that with a view to further developing their electric furnace business in France, French possessions, and countries under the protection of France, la Compagnie Francaise Wild-Barfield has been formed with offices at 102, Rue du Faubourg Poissonnière, Paris.

On September 29th, MESSRS. L. E. WILSON & CO. are removing their offices and stores to 62a, Mosley Street, Manchester.

On September 27th, MESSRS. F. and A. PARKINSON, LTD., are removing their London offices to larger premises at 47, Victoria Street, S.W.1. Telephone No.: "Victoria 8208."

The CITY OF LONDON ELECTRIC LIGHTING CO.'s registered offices are being removed to Falcon House, Aldersgate Street, London, E.C.1, on September 29th.

Catalogues and Lists.—MESSRS. D. H. BONNELLA & SON, LTD., 46-48, Osnaburgh Street, Euston Road, N.W.1.—Two illustrated and priced leaflets advertising crystal sets and radio components, and ratchet spanners respectively.

MESSRS. H. W. SULLIVAN, LTD., Winchester House, E.C.2.—A well-illustrated and priced catalogue of electric fires for the 1924-25 season; also a folder of the same nature.

THE BRITISH VACUUM CLEANER AND ENGINEERING CO., LTD., Parson's Green Lane, S.W.6.—An illustrated catalogue (No. 228) dealing with pneumatic suction plant for cleaning boiler flues, &c.

THE JACKSON ELECTRIC STOVE CO., LTD., 143, Sloane Street, S.W.1.—An illustrated and priced folder advertising a number of electric fires of old and new designs.

"M.K." ELECTRIC, LTD., Wakefield Street, Edmonton, N.18.—A priced and illustrated catalogue of "M.K." plugs and sockets, switchplugs, appliance connectors, switches, &c.

THE SUN ELECTRICAL CO., LTD., 118 and 120, Charing Cross Road, W.C.2.—A catalogue of electric fires of the company's and other makes. Fully illustrated and priced.

THE FOSTER ENGINEERING CO., LTD., Morden Works, Wimbledon, S.W.19.—An illustrated pamphlet containing a list of customers for the company's transformers, and a blotter advertising "Apex" ironclad switch- and fuse-gear.

MESSRS. RANSOMES & RAPIER, LTD., 32, Victoria Street, S.W.1.—Well-illustrated pamphlets dealing with the company's level luffing cranes, electric locomotive hoists, and electric transporter cranes.

MESSRS. WORTHINGTON-SIMPSON, LTD., Queen's House, Kingsway, W.C.2.—Publication No. 1,112, illustrating and describing very fully condensing apparatus of various types.

VENNER TIME SWITCHES, LTD., 45, Horseferry Road, Westminster, S.W.1.—List No. 22, containing illustrated details and prices of time switches for various applications.

THE BILLING TOOL CO., 303, High Holborn, W.C.1.—An illustrated list of circular saw benches, bench drills, vices, grinders, and many other tools. Priced.

METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester.—Small Motor List No. 10/03, illustrating and describing d.c. and a.c. utility motors of 0.2 and 0.25 h.p. Priced.

SIMPLEX CONDUITS, LTD., Garrison Lane, Birmingham.—Catalogue No. 1,040, dealing with industrial lighting equipment. Illustrations and prices are given of many types of lan-

terns, signs, lampholders, wall-brackets, and other fittings. The publication contains a great deal of technical information.

MESSRS. JAMES TATE & Co., Victory Works, East Parade, Bradford.—An illustrated leaflet describing a patent electric stop-motion and valve-closing apparatus and accessories.

THE GENERAL ELECTRIC Co., LTD., Magnet House, Kingsway, W.C.2.—Leaflet No. H. 3419, advertising the "Magnet" domestic outfit, comprising an electric kettle, a toaster, an iron, and a pedestal heater. Illustrated and priced.

AUTOMATIC & ELECTRIC FURNACES, LTD., 173-175, Farringdon Road, E.C.1.—"Heat Treatment Bulletin, No. 33," demonstrating the economy secured by the use of a super-heated electric furnace, with a non-magnetic detector, for hardening steel parts.

THE VISCO ENGINEERING Co., LTD., 82, Victoria Street, S.W.1.—A well illustrated pamphlet dealing with applications of the "Visco" air filter.

THE PARSONS MOTOR Co., LTD., Town Quay Works, Southampton.—An illustrated and priced catalogue showing the use of "Parsons" engines in a number of applications—generating and welding sets, pumping plant, air compressors, &c.

Norwegian Tariffs.—Article 424 of the Norwegian Customs Tariff exempts motors and other apparatus which are not made in the country from Customs dues. Among the 150 items enumerated are steam turbines, generator turbines, carbon brushes of dynamos, electric drills, &c. To secure exemption from the dues the importer must submit designs or illustrations of the articles in question, the invoice, and an explanation of the methods of working.

New French Companies.—The Société des Chutes de la Gillarde has been formed with a capital of 500,000 fr. to carry out hydro-electric work in the Upper Alps.

The Société Hydroélectrique du Calvados has been embodied at Thury-Harcourt, with a capital of 2,000,000 fr., to erect and work a hydro-electric station at Silly (River Orme).

The Compagnie Parisienne de Locations Electriques has been constituted at Paris (25, Rue d'Amsterdam), with a capital of 1,000,000 fr., for the building, purchase, and sale of electrical installations.

La Société des Forces Motrices du Lot is the name of a new company which has recently been formed in Paris with a capital of 200,000 fr. to establish a plant to utilise the water power of the Colagne Falls in the Marvejols district.

Irish Free State Electrical Imports.—From the latest official figures available in the Irish Free State, it appears that the total value of the imports of electrical goods and apparatus into the Irish Free State in May of this year was £44,326. For the four months from January to April the average value of the imports was £36,398 per month. This represents an increase on the month's trading of £7,928, and provides a significant indication of the present growth of the trade. The amount, £44,326, was made up as follows:—

	£
Electric wires and cables, insulated	7,134
Telegraph and telephone instruments and apparatus	1,193
Electric lamps and parts	2,228
Batteries and accumulators, including parts	1,233
Electric lighting accessories and fittings	3,603
Wireless sets and parts	18,975
Other electrical goods and apparatus	9,960
Total	£44,326

The value of the total imports to the Irish Free State for the five months, January—May, was £189,918.—*Irish Electrician.*

British Industrial Associations and Government Trade Negotiations with Germany.—In the course of its communication to the Prime Minister on the importance of the Government conferring with the Trade Associations when it is negotiating a new Commercial Agreement with Germany, the Federation of British Industries says:—"It appears to the Federation to be of the utmost importance that the representatives of H.M. Government in these negotiations should be in the closest and most constant touch with industrial and commercial interests. The experience of past commercial negotiations has shown the importance and the value of full and frequent consultation between the Government Departments concerned and the responsible organisations of industry and commerce. The gravity and complexity of the issues involved in the present instance render such consultation even more necessary, especially when in negotiation with the German Government, whose established practice it is to maintain daily touch with German industrial organisations in such matters. . . .

"The Federation feel that should a committee be appointed by the Government to advise them in these matters, as the Prime Minister has already suggested, it is of the utmost importance that its *personnel* should not only be such as to command the fullest confidence of the interests concerned, but that they should be in the closest and most constant communication with the responsible organisations of the interests they represent. At the same time, the urgency of the matters under consideration, and the necessity of prompt decisions, should fresh points arise during negotiation, will involve constant communication between these representatives and the Government Departments concerned.

"It appears, therefore, to the Federation that there might be considerable advantage in adopting the practice frequently successful during war, of constituting a composite committee consisting both of official representatives of the departments concerned and of representatives of industry, commerce, and finance, the business representatives on such a committee being kept in touch with the interests they represent through the different trade and other organisations.

"Whether this plan or any other be adopted by His Majesty's Government, the Federation would urge most earnestly that both industry generally and the particular trades affected by particular points should be consulted fully and at every step in the negotiations."

A Smoke Abatement Exhibition.—The Manchester Electricity Department, in co-operation with the British Electrical Development Association and several local firms, is arranging a smoke abatement exhibition at Manchester, from November 4th to 15th. The exhibition will be composed of five sections:—An "all-electric" house; domestic power and lighting; industrial heating and cooking; industrial power; and shop-window lighting.

Electrical Salesmanship Conferences. — In the West Riding (Aire and Calder) Electricity District monthly sales conferences are to be held under the auspices of the British Electrical Development Association, Inc. They will be held alternately at Bradford and Leeds, commencing at Bradford. At the first (October 2nd) Mr. J. W. Beauchamp will give an address on "The E.D.A., its Present Position, Work, and Latest Developments." The events for later meetings will be:—November: Mr. W. F. T. Pinkney, on "American Salesmanship as Applied to Electrical Merchandising"; December: Mr. G. P. Garbett, on "Illuminated Signs"; January, 1925: Mr. W. E. Bush, on "Modern Electric Lighting Equipment"; February: Joint meeting with the I.E.E., on "Domestic Electrical Apparatus" (informal discussion); March: Mr. W. Y. Anderson, on "Selling Electric Power"; April: Mr. R. Hardie, on "Electric Cooking Problems." The hon. secretary, Mr. C. E. Allsopp (sales engineer, Bradford Corporation Electricity Department), 45-53, Sunbridge Road, Bradford, will forward particulars from time to time to all interested who will send their names and addresses to him.

Super-Cable Manufacture.—The *Electrical World* for September 13th notes with pleasure that American manufacturers are hard at work developing and testing e.h.p. cables and that recently "one home manufacturer" has joined forces with an outstanding British cable manufacturer for the very purpose of specialising in e.h.p. cables of American make. "Central-station engineers and operators can thus be sure that within a year the long-sought-for super-tension cables will not only be available for service but will also carry with them some guarantee of performance."

Book Notices.—"The Secrets of Mail Order Selling," by Cyril C. Freer. (Pp. 229; 63 figs.) London: The Library Press, Ltd. Price 15s. net.—This work deals with the organisation of a postal sales business in its various phases. A great part of it is devoted to the consideration of advertising, and the illustrations depict in the main good and bad examples of Press advertisements.

"Heating Boilers." (Pp. xii+55; 31 figs.) Manchester: The National Boiler and General Insurance Co., Ltd. Price, 1s. 6d.—This contains specifications for and illustrations of various types of boilers for domestic and other hot-water systems.

"The Wireless Press Ezi-Wiring Series." No. 1, "A Three-Valve Portable Receiver," by H. S. Pocock. No. 2, "A Three-Valve Receiver," by F. H. Haynes. No. 3, "A Two-Valve and Crystal Reflex Receiver," by W. James. Price 2s. each. "The Amateur's Book of Wireless Circuits," by F. H. Haynes. Pp. 124, illustrated. Price 3s. 6d. net. London: The Wireless Press, Ltd.

Journal of the Institution of Electrical Engineers, Vol. LXII, No. 333. London: E. & F. N. Spon, Ltd. Price, 10s. 6d.—The September number contains the following papers:—"The Future of Main-Line Electrification on British Railways," by Lt.-Col. H. E. O'Brien, D.S.O.; "Selection of Ball and Roller Bearings for Electrical Machines," by Mr. T. D. Trees; "Faithful Reproduction in Radio-Telephony," by Mr. L. C. Pocock.

Chinese Notes.—A 300-kW gas-engine set has been installed in the Yangchow power station.

The authorities in Changchun, Kirim province, are constructing new telephone lines at a cost of 40,000 dols. The contract calls for the purchase of 4,700 poles, 8,000 insulators, and other accessories.

About 100,000 dols. has been raised for the establishment of an electricity undertaking in Luchow (Szechwan). A contract has been entered into with the Siemens Co. for the supply of the machinery.

The Kien-Ou Electricity Co., and the Kienao Electric Light Co. have recently commenced operations in Fukien province.

Statistics in Government Publications.—The Permanent Consultative Committee on Official Statistics has issued Volume Two of its annual Guide to Current Official Statistics (H.M. Stationery Office, price 1s. net, post free 1s. 4½d., pp. 306). The volume continues the detailed and systematic survey, commenced in the first issue, of the statistics contained in all current official publications.

Local Exhibition.—PLYMOUTH.—Last week a radio and electrical exhibition was opened at the Guildhall by the Mayor (Mr. S. Stephens). A large collection of sets, components, and accessories was on view.

British Trade Mark Applications.—The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from the dates mentioned :—

Tudoradio (lettering and design). No. 444,518. Class 8.—Wireless telephonic receiving and transmitting apparatus, but not including electrical storage batteries or goods of a like kind. Oscar Colin Morison and John Herbert Spottiswood, trading in co-partnership at the Tudor Works, Abbey Road, Park Royal, London, N.W. September 17th, 1924.

Rodeo. No. 450,346. Class 8.—Instruments and apparatus for use in wireless telegraphy and telephony. Sel-Ezi Wireless Supply Co., Ltd., 6, Greek Street, London, W.1. September 17th, 1924.

Finstone. No. 451,075. All goods in Class 8.—George Frederick Amos Stone, 2, Finsbury Avenue, Eldon Street, London, E.C.2. September 17th, 1924.

Rejuvenos. No. 450,315. All goods in Class 11.—Alfred Lloyd, electrical engineer, 47, Brockenhurst Gardens, Mill Hill, London, N.W.7. September 17th, 1924.

Ferrowatt. No. 445,550. Electric incandescent lamps (ordinary).—Julius Axelrad, 25, Mornington Crescent, London, N.W.1. September 17th, 1924.

Receptone. 450,059. Class 13. Electrical conductors composed of a plurality of wires or metal strips for use as aerials in wireless telephony.—William Paton, Ltd., Johnstone Mills, Johnstone, Renfrewshire, N.B. September 17th, 1924.

British Empire Exhibition Notes.—About 300 of the employés of the Frodsham works of the British Insulated and Helsby Cables, Ltd., recently paid a visit to the exhibition, making the journey by a special train. A works committee, of which Mr. W. Burrows was organising secretary, had charge of the arrangements.

It is officially announced that the Exhibition will remain open until November 1st. The question of re-opening the Exhibition next year is still under consideration.

Lead.—Reporting on September 20th, Messrs. James Forster & Co. stated :—" If, as looks likely, imports continue on recent lines, it will take a lot of manipulation and money to hold present values. Consumption is well maintained, the sheet and pipe output for August again being about 8,000 tons, while the electrical trades are busy, although perhaps not quite at recent high pressure, but, as a rule, consumers have ample stocks. The Board of Trade returns for August are :—Imports, 25,276 tons; exports, 1,982 tons; left for home absorption, 23,294 tons. 'Left for home absorption' for the last four months=19,622 tons per month and 50 per cent. more than the average for last year."

Catalogues Wanted.—MESSRS. MATTHEWS & LEWIS, of 4, Mill Road, Cambridge, ask for trade catalogues and price lists of electric signs, window attractions, electric toys and other winter and Christmas novelties.

Vickers Water Turbines for New Zealand.—The Hydro-Electric Department of Messrs. Vickers, Ltd., has received an order from the Government of New Zealand for two large water turbines, with an output of 12,650 h.p. each. These will be installed at Lake Coleridge in the South Island, and will provide power for Christchurch, Ashburton, Timaru and district. The turbines will be constructed at Barrow-in-Furness, and will provide a considerable amount of employment.

Report Upon Egyptian Conditions.—The British Commercial Secretary at Cairo (Mr. E. Homan Mulock) has reported to the Department of Overseas Trade upon the economic and financial situation of Egypt. (Stationery Office, 1s. 6d. net.) In the course of the report it is stated that for the third time since the war the total foreign trade of Egypt has passed the hundred million mark, and for the second successive year the trade balance has been favourable. The 1924-25 Budget allocates about £E227,000 for harbour extensions and works, and about £E120,000 is to be expended on telephone extensions of various kinds. The report mentions the new joint stock company regulations, which, *inter alia*, prescribe that all foreign companies must include an Egyptian among their directors, and must publish balance sheets in the newspapers. Imports of British iron and steel goods generally are said to have shown an upward tendency. Electrical machinery was imported to the value of £E144,361 in 1923, as compared with £E196,409 in 1922. Great Britain's share of this trade declined from £E52,246 to £E26,225. Imports from France showed a further decrease. On the other hand, internal-combustion engines rose in total value from £E222,340 to £E255,402, and the British share from £E71,248 to £E147,399; Swiss exports under this head showed a decrease. Scientific instrument imports showed a small decline at £E116,767; the British participation was slightly higher (£E49,034). Among other matters with which the report deals are radio installations. It is said that although the ownership and use of private transmitting apparatus is forbidden, there are no restrictions on the importation of this or receiving apparatus. The whole question of private transmission and broadcasting is under consideration by a Government committee.

American Electragists.—The Association of Electragists is holding its annual convention at West Baden Springs, from September 29th to October 4th. Our transatlantic cousins are entitled to adopt for themselves whatsoever description they please without criticism from us, but perhaps it is due to our readers that we should explain that an "electragist" is a "contractor-dealer," at any rate, we suppose so, seeing that the convention is expected to bring together the greatest gathering that has ever been held of men of this double-barrelled calling. The Electragists will discuss a number of serious matters, but they are essentially a happy people, notwithstanding that reports say that they are not making any money selling electrical appliances at the present margins and with the present methods of doing business in the States. They have committees set up for the organisation of sports, including golf, tennis, baseball, billiards, and bowling, and for four days the hours from 2 to 6 o'clock p.m. will be thus employed, and every night dancing will round off the day's programme. The subjects for papers and discussions include: Your responsibility as an Electragist; wholesale distribution; distribution of motors; distribution of appliances; Can the contractor make a profit as a dealer?; financing, credits, buying, selling, and collecting; cost studies and estimating; handling the big job; managing the motor repair shop; old house-wiring on a big scale; standard accounting plan in Milwaukee; organising and handling the business; tendency towards monopolistic insurance; and so on. Our contemporary, the *Electragist*, in referring to the convention, stated that the gathering was going to take up the most important question that confronted the contractor-dealer branch of the industry—that of merchandising profits.

Unemployment.—There was a small further increase in the number of unemployed during the week ended September 8th. The total on this date was 1,163,600, as compared with 1,162,880 a week earlier. The reduction since the beginning of the year now stands at 122,023.

Employment During August.—The September *Ministry of Labour Gazette* states that although employment in the engineering trades generally continued bad and experienced a decline, in electrical engineering it continued fairly good. The unemployment totals as at August 25th were as follows:—Electrical wiring and contracting, 1,222 (0.2 per cent. increase); electrical cable, wire and electric lamp manufacture, 5,608 (0.5 per cent. increase); gas, water and electricity supply industries, 10,869 (0.5 per cent. increase); and tramway and omnibus services, 3,391 (0.4 per cent. increase).

The Russian Agreement and British Trade.—The Executive Committee of the Federation of British Industries has issued a statement with regard to the recent treaty with Russia :—In the opinion of the F.B.I. the draft treaties recently negotiated between representatives of His Majesty's Government and of the Union of Soviet Republics are not of such a character as to promote British trade with Russia, or to restore satisfactory commercial relations between the two countries; contain articles calculated to prejudice British commercial relations, both with Russia and other countries; and, in general, represent a surrender of rights and principles which are essential to the welfare of British industry. They therefore trust that these draft treaties will not be ratified.

The Committee concludes its statement by saying that the treaties do not appear to contain any proposals calculated in practice to "extend and develop the commercial relations between the two countries"; to place them "on a firm, just, and durable basis"; or "to remove all causes of friction and disagreement." On the contrary, they not only involve substantial concessions from His Majesty's Government which, *inter alia*, involve a serious sacrifice of the rights and interests of British subjects and embody financial proposals of a radically unsound character, but by the vague, inconclusive, and impracticable character of the arrangements proposed for the settlement of Russian debts and compensation, and by the number of the vital questions at issue between the two countries which are left for further consideration, they actually create fresh causes of probable friction and disagreement.

In a letter addressed to the Prime Minister in February last the Federation reiterated the opinion which it had expressed to the Government on other occasions, that "if any development of trade is to take place between Great Britain and Russia, and if any confidence is to be shown by British business interests in the possibility of such a trade, it is essential that at the forthcoming conference the Soviet Government should recognise fully and without any qualifications their liability to discharge in full their debts."

New Belgian Companies.—The following companies have recently been registered in Belgium :—

Société Electro-Mécanique Luth & Rosen (Brussels); capital 100,000 fr. This is a branch of the Swedish firm of Luth och Rosens Elektriska Aktiebolag.

Electricité G. Kanters et Cie. (Ixelles); capital 500,000 fr.; to undertake the manufacture and sale particularly of electrical materials.

Accumulateurs Erdé (Genappe); capital 325,000 fr.; for the manufacture and sale of accumulators and electrical apparatus and accessories.

For Sale.—On October 23rd, by direction of the George Cohen and Armstrong Disposal Corporation, Messrs. Fuller, Horsey, Sons & Cassell will sell by auction at the National Projectile Factory, Lancaster, generating and pumping sets, motors, switchboards and other plant and machinery. (See our advertisement pages to-day.)

The Russian Electrical Bank.—According to a Moscow despatch (*Reuter's Trade Service*) preparations are being energetically pushed on for the opening of the Elektrobank, which is fixed for October 1st.

Exhibitions in the Midlands.—Under the auspices of the Smethwick and Oldbury Electricity Supply (the Shropshire, Worcestershire, and Staffordshire Electric Power Co.) a demonstration of electric service for the home and business was held at the Drill Hall, Smethwick, from September 16th to September 20th. The opening ceremony was performed by Mr. H. S. Welch (president of the Smethwick Traders' Association), in the presence of a large assembly. The exhibition was of a very representative character. In a wide variety of directions the advantages of electricity as an illuminant were demonstrated, and prominence was also given to the claims of labour-saving appliances. A feature of the display consisted of lighting fittings, with model rooms and shop fronts. The British Thomson-Houston Co., Ltd., was responsible for the lighting display, and the same company also exhibited "Tungar" battery chargers. Cooking and heating appliances were shown in great variety; also laundry equipment for the home and labour-saving appliances for the home and business. The domestic appliances demonstrated by the Western Electric Co. ranged from vacuum cleaners to cookers, dish-washers, washing machines, water heaters, irons, and radiators; and cookery demonstrations given by the Hotpoint Co. attracted a large amount of attention. The Jackson Electric Stove Co., Ltd., showed the rapidity with which water for bathrooms may be heated by electricity. The Prideaux Manufacturing Co., Birmingham, contributed an interesting collection of electric sign apparatus. Messrs. Parnall & Co., of Birmingham, showed electrically-driven bacon-cutting machines, sausage-making machines, meat-slicing machines, and electrically-heated ham-cooking and fish and chip appliances. Messrs. W. & T. Avery displayed electrically-illuminated scales. The firm also demonstrated the ease with which special features in a shop might be electrically lighted. One stand took the form of a dining room which was efficiently lighted and heated. Coffee percolators, electric kettles, toasters and heaters were shown; and it was to be noted in relation to domestic lighting that the semi-indirect lighting with alabaster bowls continued to claim much attention. The "Santon" geyser was demonstrated, and electrically-driven Singer sewing machines were exhibited. The Hobart Manufacturing Co. displayed its "Kitchen-aid" apparatus, which carried out, among other things, cake-mixing, meat-mincing, vegetable-slicing, ice-cream-making, and egg-beating. Wiring by the "Kaleeco" surface system was exhibited by Callender's Cable & Construction Co., Ltd.

Jugo-Slavian Electrical Imports.—From a list published in last week's *Board of Trade Journal* it is seen that the value of the imports of electrical apparatus into Jugo-Slavia during July was 26,668,000 dinars (£8,300 approx.).

Report on Wireless Telephony in Hamburg.—A confidential report on wireless telephony in the Hamburg district of Germany has been prepared by the Department of Overseas Trade from information received from H.M. Consul-General at Hamburg (Mr. F. A. Oliver).

Wages and the Cost of Production.—Those were brave words that Mr. W. L. Hichens, the chairman of Cammell, Laird & Co., Ltd., spoke at the Summer School of the Independent Labour Party recently: and we marvel that he escaped with his head. Discussing the necessity for a reorganisation of the engineering industry, he expressed the view that the present trade depression was a "lingering and malignant" illness, not to be quickly cured. We could only, obviously, maintain and develop our trade if our prices compared favourably with those of our rivals in the foreign field. How was that happy end to be reached? Almost at the same moment Sir Robert Hadfield, in another place, supplied an answer. "By," he said, "railways and buyers generally insisting in their specifications that the foreign manufacturer has to comply with the same conditions in regard to hours, wages, and general terms of employment" as our own manufacturers. That view is a familiar one; but it was not Mr. Hichens's. In his view, "wages must tend to find the level of those paid by our competitors," however much we kick against the pricks and struggle to bolster them up by artificial means. "The standard of one country cannot be improved at the expense of another. Both must rise or fall together." Simultaneously, from Australia, comes the protest against the competition of iron and steel workers in England "paid about half the rate of wages" obtaining in the Commonwealth. The plain truth is that we are in a minority, just as Australia is in a minority, and that we cannot hope to impose our will on a majority when we are fighting that majority for our daily bread. Either wages in Great Britain must come down, or we must surrender our foreign trade—and much of our home trade—and try the experiment of trying to live by taking in each other's washing. Improvement in the standard of living has been hard won, and nobody wants to see even a fraction of the gains surrendered; but we are faced by a choice between half a loaf and no bread.—*Ironmonger*, September 6th.

New Indian Company.—The Nasik Electric Supply and Power Co. has lately been formed in Bombay (35 Nanabhai Lane, Fort), with a capital of 500,000 rupees.

French Reparations Tax on German Goods.—The *Journal Officiel*, on September 20th, published a decree putting a tax of 26 per cent., as from October 1st, on all goods of German origin or manufacture imported either direct from Germany or through a third country.—*Reuter*.

Victoria Falls Power Co. Employés' Demand.—It is reported that the Victoria Falls Power Co. has refused the request of its employés for extra holidays and increased wages.

Copper and Lead Prices.—Messrs. F. Smith & Co. report September 23rd:—Copper (electrolytic) bars, £66 15s., 25s. decrease; do. do. sheets, no change; do. do. wire rods, £76 15s., 25s. decrease; do. do. h.c. wire, no change.

Messrs. James & Shakespeare report September 23rd:—Copper bars (best selected), sheet and rod, £93, 20s. decrease; English pig lead, no change.

Lighting and Power Notes.

Aberdeen.—EXTENSION OF SUPPLY.—The Corporation Electricity Committee is negotiating with the Stonehaven Council for the purpose of ascertaining whether the Council would be agreeable to the Corporation extending its area of supply to Stonehaven. The electrical engineer estimates that the work proposed would cost £30,000.

Aylesbury.—LOAN SANCTIONED.—The Town Council has received the sanction of the Electricity Commissioners to the borrowing of £5,075 for mains and plant in connection with the supply to Waddesdon Manor.

Brockenhurst (Hants.).—PROPOSED ELECTRICITY SUPPLY.—Edmundson's Electricity Corporation, Ltd., has informed the local Council that it proposes to supply electricity in the parish and to apply to the Electricity Commissioners for a Special Order. Electricity will be purchased in bulk from the Lymington Electricity Supply Co., and the company has inquired if the Council would be prepared to give its approval to the scheme. The Council has decided to inquire as to the cost.

Burton-on-Trent.—ELECTRICITY SUPPLY.—The Town Council has received the sanction of the Electricity Commissioners to supply electricity to houses in Woods Lane, in the area of the Repton Rural Council, and to the Netherseal Colliery. The Repton Parish Council has accepted the terms of the borough electrical engineer for public lighting by electricity, the Council to pay for the conversion of the present lamps, and £4 10s. per lamp per annum for supply and maintenance during the winter months only.

Brazil.—HYDRO-ELECTRIC DEVELOPMENT.—Good progress is being made with the construction of the hydro-electric station on the River Parahyba by the Brazilian Hydro-Electric Co., Ltd., and it is expected that the first two units of a total capacity of 50,000 kW will shortly be put in operation. A fourth unit of 20,500-kW capacity is also being installed at the station on the Soracaba Falls by the Sao Paulo Electric Co., Ltd.

Conisborough.—PROPOSED BULK SUPPLY.—The Urban District Council is to meet Mr. C. P. Markham, chairman of the Doncaster Collieries Association, to discuss an offer by the Association, which is proposing to extend its h.p. line through Conisborough to Mexborough to supply the Council with electrical energy in bulk at 1¼d. per kWh. The Council has already asked the Electrical Distribution of Yorkshire, Ltd., to distribute electricity in its area, but it is stated that the price was considerably above that quoted by the Collieries Association.

Continental.—FRANCE.—An electricity scheme to embrace 115 townships in the Department of the Allier and three townships in the Department of Seine-et-Loire is the subject of a concession applied for by the Compagnie Centrale de Distribution d'Energie Electrique.

Conferences have been held between the Governmental and departmental engineers anent the setting up of rural electric networks to supply some 29 townships in the Department of Calvados. The current, which will be transmitted at a pressure of 13,500 V, will be furnished by three companies in the districts affected.

Dover.—LOANS.—The Town Council is applying to the Electricity Commissioners for sanction to the borrowing of £6,000 for mains and services. Sanction has been received to a loan of £350 for transformers.

East Grinstead.—LOANS.—The Urban District Council has received the sanction of the Electricity Commissioners to the borrowing of £7,122 for feeder mains and plant at the electricity works. The Commissioners have requested the Council to forward further information with regard to the application for sanction to a loan of £3,625 for distributing mains, services, and meters.

Hemsworth.—ELECTRICITY SCHEME.—The Electricity Committee has drafted an electricity scheme which will shortly be submitted to the Rural District Council and the Electricity Commissioners for approval. The scheme provides for three sub-stations at Frickley, Grimethorpe, and Brierley. During

the first year it is proposed to lay distributing mains through South Elmsall, Moorthorpe, and South Kirkby. At the same time distributing systems would be installed in Shafton, South Hiendley, and Ryhill. The estimated capital cost during the first year would be £28,000. In the second year the h.p. mains would be extended to the Ackworth district at an estimated cost of £23,000, and during the third year extensions are proposed from Frickley sub-station to Upton and North Elmsall, and the necessary distribution system installed at a cost of £14,000. The estimated cost of the whole scheme is £65,000.

London.—SHOREDITCH.—The accounts of the borough electricity undertaking for the year ended March 31st last record a total income of £138,976, as compared with £144,210 in the preceding year, the reduced income being due to the reduction in prices which came into force at the end of June, 1923. The net profit, after providing interest, paying off loans, &c., amounted to £14,717, out of which £7,000 has been contributed to the relief of the rates. The sales of electrical energy increased from 12,589,915 to 14,126,067 kWh.

Maidstone.—ELECTRICITY SCHEME.—The Electricity Committee has submitted to the directors of the Associated Portland Cement Manufacturers terms for the supply of electricity to the Burnham Cement Works. The adoption of the scheme will involve a capital expenditure of between £90,000 and £100,000.

North-West Midlands Electricity District.—INTERIM INQUIRY.—The Electricity Commissioners intend to hold an interim local inquiry in the Town Hall, Wolverhampton, on October 21st, 1924, at 10.30 a.m. and following days, if necessary, with reference to the proposed amendments to the scheme originally submitted by the Conference of Authorised Undertakers and to the area now proposed to be constituted an electricity district.

Paisley.—YEAR'S WORKING.—The accounts of the Corporation electricity undertaking for the year ended May 15th last show that the total income was £89,836, as compared with £79,942 in 1922-23. The working expenses amounted to £51,206, as against £44,362, leaving a gross profit of £38,630 (£35,380). After the payment of interest and sinking fund charges there remained a net profit of £4,787, which was placed to reserve. In the previous year there was a profit of £2,511. The sales of electrical energy increased from 7,944,402 to 9,236,623 kWh, and the maximum supply demanded from 4,450 to 5,000 kW. During the year over eight miles of h.p. and l.p. cables were laid.

Portmadoc (North Wales).—OPPOSITION TO SCHEME.—On the ground that the electricity charges are excessive, the local Council has decided to oppose the application of the Gwynedd Trust for a Provisional Order to extend its area of supply in South Carnarvonshire, and West Merionethshire.

Portsmouth.—YEAR'S WORKING.—The income of the municipal electricity undertaking (engineer: Mr. B. Handley) during the year ended March 31st last was £129,113, as compared with £133,636 in the previous year. After deducting working expenses, capital charges, &c., there was a net surplus of £17,904, as against £23,974 in 1922-23. This profit was allocated as follows:—Reserve fund, £7,904; contributed to rate relief, £10,000. During the year the undertaking for the first time supplied electricity outside the borough, and is now supplying the Chichester Borough Council and the Fareham Urban District Council in bulk. Extensions are also to be carried out at Hayling Island. At present the Corporation tramways undertaking has its own generating station, but it has now been decided that the dual supply is to be abolished. The Electricity Department is to provide two rotary converters for the tramway sub-station and supply the necessary electrical energy.

LOAN.—The Town Council has applied to the Electricity Commissioners for sanction to a loan of £50,000 for mains and services.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

SOUTH SHIELDS.—Lighting, flat rate: From 5d. to 4½d. per kWh. Power and heating: From 1½d. to 1½d. per kWh. Traction: From 1½d. to 1d. per kWh.

MILNROW.—Lighting, flat rate: From 7d. to 6½d. per kWh.

ABERDEEN.—Lighting, flat rate: 5½d. per kWh. Maximum demand rate: Over 5,000 kWh per half year, 7½d. per kWh for the first hour daily and 2½d. per kWh for all subsequent supply.

ST. PANCRAS.—Private lighting: From 4½d. to 4d. per kWh. Street lighting: From 2d. to 1½d. per kWh.

Spalding.—ELECTRICITY SUPPLY.—The Urban District Council having decided to carry out a sewerage scheme which will be electrically equipped, is applying to the Electricity Commissioners for sanction to carry out an electricity scheme at an estimated cost of £15,000.

Special Orders.—SUBMISSIONS AND AN APPLICATION.—The Electricity Commissioners have submitted the following Special Electricity Orders to the Minister of Transport for confirmation:—Nuneaton (Extension), in favour of the Nuneaton Borough Council; and Sheringham and District, granted to the Sheringham and District Electricity Supply Co., Ltd. The promoters of the Aber Artro Hydro-Electric Lighting and Power Works Special Order have asked for this Order to be amended to include the urban district of Barmouth.

Weymouth.—LOAN SANCTIONED.—Sanction has been received from the Electricity Commissioners to the borrowing of £10,000 by the Town Council for mains and switchgear.

Wivenhoe.—PURCHASE OF UNDERTAKING.—Mr. A. H. Ellis recently informed the Urban District Council that he was willing to accept the offer of the Council to purchase the electricity undertaking for £2,000. The Council has decided, however, not to proceed with the purchase.

Tramway and Railway Notes.

Continental.—FRANCE.—The report for 1923 of the Paris, Lyons, and Mediterranean Railway Co. states that the electrification of the line Culoz-Modane, which has to be converted in the first place, is in full course of being realised, and the works will be completed in 1926. The sub-stations are being erected, and the company has ordered 34 electric locomotives, of which four are of the high-speed class, of different types, which will be tested this year, and also 50 goods locomotives. It is intended in the near future to adapt the Chambery depôt for electric traction, and at the same time it will be necessary to enlarge its scope so as to permit of dealing with the future augmentation of the traffic on the electrified line of Modane.

BELGIUM.—A Belgian syndicate is interesting itself in a scheme for the construction of an underground electric railway in Brussels.

Irish Free State.—CORK.—At a meeting of the Cork Progressive Association, it was intimated that, as a result of negotiations between the Free State Department of Industry and Commerce and the directors of the Cork Electric Tramways and Lighting Co., the latter had agreed to reduce the 2d. minimum fare to 1d. and to revise the fare stages.

Liverpool.—"ALL-NIGHT" SERVICE.—The Tramways Committee has decided to discontinue the all-night tramcar service following the presentation of a report by the tramways manager, Mr. P. Priestly, showing that during the eight weeks of the experiment the tramcars engaged in this service made 418 journeys when no passengers were carried, 503 when only one passenger was carried, and 426 when only two passengers were carried. It was stated in committee that the running of the tramcars during the night would involve the Corporation in a loss of £9,000.

London.—HEATING ON TRAMCARS.—A trial run was recently made from Victoria Embankment to Abbey Wood of a L.C.C. tramcar fitted with an experimental heating device. It is proposed to install heating devices in all L.C.C. tramcars.

"UNDERGROUND" IMPROVEMENT SCHEME.—Considerable progress has been made with the scheme of improvement on the Underground railways, which, when completed, will have cost £12,500,000. The Moorgate-Clapham section of the City and South London Railway is nearing completion and will be opened for traffic on December 1st next. On this date trains will begin working between Clapham and Edgware. The new Oxford Circus station will be completed early in 1925, and escalators will supersede the present lift connection with the Central London platforms. The new station will be capable of dealing with 50 million passengers a year. It is anticipated that the Morden and Kennington extensions will be completed by the end of 1925. The City and South London Railway is to be extended through Balham, Tooting, and South Wimbledon to Morden, and the Kennington extension will link up the Hampstead "tube" with the City and South London Railway. An entirely new station is to be constructed at Piccadilly Circus, and the reconstruction of the Leicester Square station will be put in hand in the near future.

Telegraph and Telephone Notes.

Greenland.—NEW RADIO STATIONS.—The Danish Government has sanctioned a credit for the erection of four new radio stations in Greenland. The stations will be at Julienhaab, Angmagsalik, Godthaab, and Godhavn, respectively. The largest will be the first-named, using the Poulsen system, with 5-kW power. The second station will operate on the spark system, and the last two will use valves. The question has been debated whether the young Danish industry is competent to supply the plant, but the contracts have been finally placed with the Dansk Radio Aktieselskab, a company comprising a number of Danish firms. The outlay involved is estimated at 900,000 Danish crowns.

Italy.—RADIO TELEGRAPHY AND TELEPHONY.—A confidential report on the development of radio telegraphy and telephony in Italy has been prepared by the Department of Overseas Trade from information received from the Acting British Consul-General at Milan and issued to firms whose names are entered upon its special register. United Kingdom firms desirous of receiving a copy of this report, together with full particulars of the special register service, should communicate with the Department at 35, Old Queen Street, London, S.W.1.

Pacific Cables.—RATE REDUCTION.—Mr. Gibson, Federal Postmaster-General, who has just returned to Australia from the Postal Conference at Stockholm, announces a 20 per cent. reduction in cable rates between England and Australia, with a further reduction when the duplication of the Pacific cable has been completed. The Pacific Cable Board, in conjunction with the Imperial Cables, as well as the Eastern Telegraph Co., are to reduce the ordinary telegraph rate from Great Britain to Australia from 3s. to 2s. 6d. a word, as from December 1st next. The rate to New Zealand will be reduced from 2s. 8d. to 2s. 3d. a word. The rates for deferred traffic will be correspondingly reduced from 1s. 6d. to 1s. 3d. per word to Australia, and from 1s. 4d. to 1s. 2d. a word to New Zealand. The same rates will apply *via* the Western Union and Commercial Cable Co.'s routes in conjunction with the Pacific cable.

Radio Sub-Station Control.—WEMBLEY EXPERIMENT.—Experiments have been carried out by the Metropolitan-Vickers Electrical Co., Ltd., in connection with the starting and stopping of machinery by radio signals. The signals are transmitted from the Trafford Park works, Manchester, and are picked up on a receiver at the British Empire Exhibition. They actuate a special selective relay, which causes the automatic rotary converter equipment exhibited by the firm to function as required. Several successful demonstrations have recently taken place.

Russia.—TELEPHONE SERVICE.—Telephonic communication is reported to have been recently established between Helsingfors (Finland) and Leningrad and Moscow (Russia).

The Telegraph Service.—OFFICE HOURS.—The Postmaster-General has ordered an inquiry into the cost of keeping telegraph offices in London and the larger provincial towns open for an extra hour at night. If the committee now sitting approves of the project some main offices will remain open until 8 p.m., the pre-war time, instead of closing at 7 p.m. as at present.

Radio Notes.

Broadcast Reception at Sea.—LICENCES ISSUED.—Licences to use apparatus for the reception of broadcast programmes on British ships can now be issued. Individual licences in the name of each passenger or member of the crew will not be necessary. One licence will suffice for each ship, and in the case of ships equipped with commercial installations the following special conditions are imposed in addition to the conditions printed on the licence:—The use of a ship's main aerial for the reception of broadcast programmes is prohibited except when the ship is in port. The broadcast receiving apparatus and aerial must not be connected in any way with the ship's main installation, and must not be worked by the ship's operator during his hours of watch. Persons using the apparatus must sign the usual declaration of secrecy if they become able to intercept private telegrams to and from the ship, and it is within the competence of the master to prohibit the use of radio apparatus by passengers or crew if he thinks it desirable to do so.—*Morning Post.*

Lectures.—L.C.C. TEACHERS.—The London County Council has arranged a course of four lectures, for teachers only, on radio telephony and broadcasting, in order that they may be familiarised with certain problems that have to be solved in school broadcasting. Captain P. P. Eckersley, the chief engineer of the British Broadcasting Co., will give the lectures at the Polytechnic, Regent Street, on Friday evenings in the autumn term.—*The Times.*

Licences.—STEADY INCREASE.—It is reported that some 912,000 receiving licences were in force at the end of August, 1924, which figure represents an increase of about 40,000 since July.

Reception on Moving Vehicles.—An experiment in broadcast receiving is to be made by the National Omnibus & Transport Co., Ltd., which is to start a monthly service for theatre visitors from Colchester to London on October 2nd. The omnibus will be fitted with a special set, including a loud-speaker and headphones for each passenger.—*Daily Mail.*

Experiments with the object of receiving broadcast messages on the Rome-Naples express train are reported to have been only partly successful.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared in our advertisement pages.)*

Open.

Australia.—MELBOURNE.—October 24th. 22,000-V cable and accessories for the Yallourn power scheme. (September 12th.)

November 26th. Melbourne and Metropolitan Tramway Board. Automatic sub-station equipment.

COMMONWEALTH POSTMASTER-GENERAL'S DEPARTMENT.—October 7th. Lamps, lamp caps and sockets, and protective apparatus.

October 14th. Bells and buzzers.

November 11th. Switchboards, cord types, and spare parts.

November 18th. Transmitters, receivers, &c.

NEW SOUTH WALES.—January 29th, 1925. Postmaster-General's Department. Automatic c.b. telephone equipment for the offices of the Ministry of Public Works.

SYDNEY.—N.S. Wales Government Railways and Tramways. November 5th. Three 12.5-kW and one 20-kW motor-generator sets.

November 19th. Switch-operating and lighting batteries. Chief electrical engineer, 61, Hunter Street, Sydney.

NEWCASTLE (N.S. WALES).—November 25th. Caledonian Collieries, Ltd. Turbo-alternators, condensers, pumps, boilers, pipework, superheaters, chimney, fans, switchboards, transformers, &c. (September 12th.)

Belgium.—October 2nd. Municipal authorities of Schaerbeek, Brussels. 3,000 metres of l.p. armoured cable, 1,300 connection boxes, 550 electricity meters, &c. Tenders to be submitted on forms with a Belgian 75-c. stamp affixed. Particulars from Service de l'Electricité, Hotel Communal, Schaerbeek.

October 1st. The Belgian State Railway authorities (Office de l'Electricité), 25, Rue de la Charité, Brussels, are inviting tenders for the supply of a quantity of armoured cable, junction boxes, and insulating material. (Cahier des Charges Special No. 4-108.)

October 1st. The Belgian Post and Telegraph authorities, at La Salle Madeleine, Brussels. Five lots of telegraph and telephone wire totalling 2,605 km., and 111 km. of various kinds of cable divided into seven lots. Particulars (Cahier des Charges Special No. 3-55) for 5 fr.

Bradford.—October 16th. Corporation. One 500-kW automatic converting plant and switchgear; and four traction feeder panels. (September 19th.)

Buenos Aires.—October 6th. Supply of machinery and equipment for a hydro-electric station to be built at the city of Mendoza for the supply of current to the works connected with the building of a tunnel across the Precordillera. Particulars from the Direction Technique, 1840, Calle Charcas, Buenos Aires.

Canterbury. — October 24th. Electricity Department One 1,250-kW, 3-phase turbo-alternator and condensing plant (See this issue.)

Dublin.—September 29th. Electric lighting installation at Ship Street and Clock Tower Government Buildings, Dublin Castle. Specifications from Mr. J. J. Healey, secretary, Office of Public Works.

Dundee.—October 20th. Electricity Department. One 12,500-kW turbo-alternator set and condensing plant. (September 19th.)

Edinburgh.—October 13th. Corporation Electricity Department. Two 65/80,000-lb. water-tube boilers, with economisers, pulverised fuel plant, &c., for the Portobello station. (September 19th.)

September 30th. Education Authority. Heating installation and electric lighting at Bellevue Technical and Commercial School. Schedules from Mr. J. A. Carfrae, architect, 3, Queen Street; offers to Mr. John Stewart, S.S.C., executive officer, Education Offices.

Glasgow.—October 4th. Corporation Electricity Department. Various works in connection with the extension of the Dalmarnock generating station. Forms from the engineer; tenders to Town Clerk.

Hyde.—September 30th. Electric lamps, wiring, and all accessories for lighting stalls at the Corporation Market. Form of tender from Borough Surveyor, Town Hall, Hyde.

Ilford.—October 7th. Electricity Department. 660 V. paper-insulated cables and joint boxes. (See this issue.)

India.—BOMBAY, BARODA, AND CENTRAL INDIA RAILWAY CO.—October 13th. Track bonds. (September 19th.)

Knutsford.—October 1st. Bucklow Board of Guardians. Supply and erection of steam generator, motors, wiring, &c., for the Poor Law Institution. Specifications, &c., from Messrs. Cramp & Frith, consulting engineers, 33, Brazennose Street, Manchester.

London.—METROPOLITAN ASYLUMS BOARD.—October 8th. Installation of an internal automatic telephone system at Leavesden Mental Hospital, King's Langley; and the installation of a c.b. telephone system at Brook Fever Hospital, Shooter's Hill, S.E. (September 12th.)

Manchester. — September 30th. Manchester Union. Electric lighting supplies for the annexe of the Institution, Crumpsall. Particulars and specifications from Mr. E. Hargreaves, Superintendent of Works, Union Offices, All Saints', Manchester.

Mold.—October 20th. Urban District Council. The Council invites offers for the taking over of its Special Order and the institution of a scheme for the distribution of electricity in the urban district. Power will be supplied by the North Wales Power Co., Ltd. (See this issue.)

Morley.—October 7th. Town Council. Electrician's work required in erection of 48 houses on Middleton Road site. Specifications (No. 4) from Borough Engineer, Town Hall.

New Zealand.—GREY ELECTRIC POWER BOARD.—November 14th. Steam-driven generating plant.*

PUBLIC WORKS DEPARTMENT.—October 28th. Lake Coleridge Scheme. Switchboard, 6,600-V oil switches, &c.—*Tenders.*

WELLINGTON.—November 18th. Public Works Department. Switchgear for the Ngongotata sub-station, Waikato power scheme.*

Plymouth.—October 21st. Electricity Department. Four water-tube boilers, with economisers, chimney, &c. (See this issue.)

South Africa.—BEAUFORT WEST.—October 31st. Town Council. Power station plant for electric lighting scheme.*

CAPE TOWN.—October 29th. City Council. 500 or 1,000 street lighting fittings.*

Spain.—MADRID.—The Ministro de Fomento. Electrification of the third section of the railway line between Lerida and Saint Girons at an estimated cost of 8,078,950 pesetas. For particulars apply to the Excmo Señor Director-General de Obras Públicas, Madrid.

Stockport.—Electricity Department. One 12,000-kW turbo-alternator, complete with surface condenser, pumps, &c. (September 12th.)

Turkey.—CONSTANTINOPLE.—November 4th. Posts and Telegraphs Department. 100 large and 500 small voltmeters.*

Uruguay.—MONTE VIDEO.—November 19th. State Electricity Works. 30,500 kgs. of lubricating oils.*

Wigan.—September 29th. Tramways Committee. Four single-deck railless trolley vehicles. General manager, Tramway Offices, Wigan.

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Aden.—The Executive Committee of Aden Settlement has placed with Messrs. Crompton & Co., Ltd., a contract for three Vickers-Spearing boilers, three 250-kW turbo-alternators (W. H. Allen turbines and Crompton alternators), and necessary subsidiary machinery. Messrs. Barry, Wolfe Barry and Messent, of London, consulting engineers, prepared the scheme, which is for three-phase, a.c. generation at 6,600 volts, 50 cycles, and three-phase, four-wire, 230-volt, a.c. distribution. An Indian paper states that a managing engineer was to visit Aden in September or October to investigate the transmission and distribution system.

Aylesbury.—Town Council.

Transmission line (£2,731) and underground cable (£1,422) in connection with the supply of electricity to Waddesdon Manor.—Siemens Bros. and Co., Ltd.

Dublin.—Commissioners for the Borough. Accepted:—

Pneumatic sealing plant for Pigeon House electricity works (£233).—Consolidated Pneumatic Tool Co., Ltd.

One 15-kW, d.c. generator, 15-h.p. motor, switchboard, and starting panels for the Roundswood reservoir (£196).—Mawdsleys, Ltd.
—*Irish Builder and Engineer.*

Government Contracts.—The following contracts were awarded by Government Departments during August :—

ADMIRALTY (CONTRACT AND PURCHASE DEPARTMENT).

Alternators, motor, &c.—W. Mackie & Co.; Newton Bros. (Derby), Ltd.
Starters, regulators, &c., for alternators.—Newton Bros. (Derby), Ltd.
Inert cells.—General Electric Co., Ltd.
Electric travelling cranes.—Sir W. Arrol & Co., Ltd.; Vaughan Crane Co., Ltd.
Turbo-generating plant.—P. Brotherhood, Ltd.
Electrodes.—Alloy Welding Processes, Ltd.; Quasi-Arc Co., Ltd.
Soot-cleaning installation.—British Vacuum Cleaner and Engineering Co., Ltd.
Automatic telephone exchanges.—Relay Automatic Telephone Co., Ltd.; Siemens Bros. & Co., Ltd.

WAR OFFICE.

Accumulators.—Chloride Electrical Storage Co., Ltd.
Electric lighting installation at Fort George.—Ponsford & McHardy.

AIR MINISTRY.

Ignition spares.—Delco-Remy, Ltd.
Radio valves.—British Thomson-Houston Co., Ltd

POST OFFICE.

Fire-alarm apparatus.—General Electric Co., Ltd.
Telephone apparatus.—Automatic Telephone Mfg. Co., Ltd.; British L. M. Ericsson Mfg. Co., Ltd.; General Electric Co., Ltd.; Phœnix Telephone and Electric Works, Ltd.; Siemens Bros. & Co., Ltd.; Sterling Telephone and Electric Co., Ltd.; Western Electric Co., Ltd.
Protective apparatus.—British L. M. Ericsson Mfg. Co., Ltd.
Bells.—Plessey Co., Ltd.; Radio, Phonopore and Electricals, Ltd.; Sterling Telephone and Electric Co., Ltd.
Coin-collecting boxes.—Hall Telephone Accessories, Ltd.
Cable.—British Insulated and Helsby Cables, Ltd.; Callender's Cable and Construction Co., Ltd.; Connollys (Blackley), Ltd.; Enfield Cable Works, Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson and Phillips, Ltd.; Macintosh Cable Co., Ltd.; Pirelli-General Cable Works, Ltd.; Union Cable Co., Ltd.; Western Electric Co., Ltd.
Joint box castings.—Frederick Bird & Co., Ltd.; Ladywood Iron Works, Ltd.; United Steel Companies, Ltd.; John Varley, Ltd.
Dry cells.—Fuller's United Electric Works, Ltd.; Siemens Bros. & Co., Ltd.
Loading coils.—Western Electric Co., Ltd.
Instrument cords.—British Insulated and Helsby Cables, Ltd.; Ward and Goldstone, Ltd.
Ducts.—Donington Sanitary Pipe and Fire Brick Co., Ltd.; Doulton and Co., Ltd.; G. Jennings; Jas. Oakes & Co.; Oates & Green, Ltd.; Sutton & Co. (Overseal), Ltd.; Jas. Woodward, Ltd.
Dynamotors.—A. W. Woods.
Motor-generator sets.—Newton Bros. (Derby), Ltd.
Cable distribution plugs.—Siemens Bros. & Co., Ltd.
Switchboard plugs.—E. Turner.
Bell receivers.—Radio, Phonopores and Electricals, Ltd.
Bronze wire.—T. Bolton & Sons, Ltd.; British Insulated & Helsby Cables, Ltd.; Richard Johnson & Nephew, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co. (incorporated in the London Electric Wire Co. & Smiths, Ltd.).
Copper wire.—T. Bolton & Sons, Ltd.; British Insulated & Helsby Cables, Ltd.; Elliott's Metal Co., Ltd.; Enfield Cable Works, Ltd.; Richard Johnson & Nephew, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co.; John Wilkes, Sons & Mapplebeck, Ltd.; Johnson, Clapham & Morris, Ltd.; Pirelli-General Cable Works, Ltd.
Flameproof wire.—Macintosh Cable Co., Ltd.
Manufacture, supply, drawing-in and jointing cable.—Paisley-British-Dalry; Johnson & Phillips, Ltd. Holmfirth, Cardiff-Caerphilly; Western Electric Co., Ltd.
Battery renewals.—City (London) exchange: Hart Accumulator Co., Ltd.
Electrical installation (Birmingham head post office).—W. T. Hollaby and Co.
Telephone exchange equipment.—Jas. Keiller & Sons, Ltd. (Dundee); Ansell's Brewery (Aston), Spiller's Milling and Associated Industries, Ltd., F. J. Parsons, Ltd., Hastings: Relay Automatic Telephone Co., Ltd. Openshaw (Manchester): General Electric Co., Ltd. Sub-contractors: Chloride Electrical Storage Co., Ltd. (for batteries), and Crompton & Co., Ltd. (for machines). Holborn Tandem: Automatic Telephone Mfg. Co., Ltd. Sub-contractors: Chloride Electrical Storage Co., Ltd., (for batteries), and Newton Bros. (Derby), Ltd. (for machines). London (Trunk) and Manchester: General Electric Co., Ltd.
Power plant, telephonic repeater station, Birmingham.—Newton Bros. (Derby), Ltd.

OFFICE OF WORKS.

Vacuum cleaning plant (House of Commons, &c.).—British Vacuum Cleaner and Engineering Co., Ltd. (Public Record Office): Sturtevant Engineering Co., Ltd.
Electric lighting (Windsor Castle and Royal College of Art).—T. Clarke and Co., Ltd.
Rotary converter, &c. (N.P.L.).—Mather & Platt, Ltd.

CROWN AGENTS FOR THE COLONIES.

Plugs.—Siemens Bros. & Co., Ltd.
Pumps.—Rees Roturbo Mfg. Co., Ltd.
Copper wire.—F. Smith & Co.

Hamilton.—Town Council.

Electric lighting work at the new Town Hall (£1,120).—D. Henderson.

London.—HACKNEY.—Works Committee. Recommended :—

Three additional electric vehicles for house collection.—Richd. Garrett and Sons, Ltd.
Steel tubs for the vehicles.—Ransomes & Rapier, Ltd.

ST. PANCRAS.—Electricity and Public Lighting Committee. Recommended :—

E.h.p. switchgear (£2,319).—Reyrolle & Co., Ltd. (Ten tenders were received.)
Steelwork for boiler house, King's Road power station (£4,351).—E. C. and J. Keay, Ltd. (Nine tenders were submitted, the specification contains a clause which provides that all steel shall be of British manufacture.)

HAMMERSMITH.—Electricity Committee. Recommended :—

500 yd. .2 sq. in. l.p. cable (£241), 500 yd. .1 sq. in. l.p. cable (£159), and 500 yd. .05 sq. in. l.p. cable (£119), total £519.—Pirelli-General Cable Works, Ltd.

Newport (Mon.).—Great Western Railway Co.

Two 6-ton electric cranes for the docks.—Clyde Crane and Engineering Co., Ltd.

Stoke Newington. — Electricity Committee. Recommended :—

Electrical installation at the flats, 356-384, Green Lanes (£570).—Mr. W. E. Westwood.

Weymouth.—Town Council.

Feeder cables (£7,273).—Johnson & Phillips, Ltd.

Forthcoming Events.

Birmingham Electric Club.—Friday, September 26th. At the Grand Hotel, Colmore Row, Birmingham. At 7 p.m. Paper on "Electric Motors for Special Purposes," by Mr. W. N. Y. King.

All-British Wireless Exhibition.—September 27th to October 8th. At the Royal Albert Hall, South Kensington, S.W.

Institution of Mining Engineers.—Thursday and Friday, October 2nd and 3rd. At the British Empire Exhibition, Wembley. Annual general meeting.

Junior Institution of Engineers.—Friday, October 3rd. At 39, Victoria Street, S.W. At 7 p.m. Lecture on "Explosions, Terrestial and Celestial," by Prof. A. W. Bickerton.

Electrical Power Engineers' Association (Southern Division).—Friday, October 3rd. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 7 p.m. Lecture on "The Scientific Treatment of Boiler Feed Water, introducing the Colloidal Aspect," by Mr. W. B. Lewis.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers or suppliers of :—

ZERENA electric welding plant.
GEM soldering irons.
SUPERIOR electric iron.
COLUMBUS electric iron.
White moulding powder similar to Bakelite.
Two-way combined ceiling rose and switch.
SIMPLICITY tumbler switches.
INDISPENSABLE electric tools.

Notes.

Re-assembly of Parliament.—The Speaker has summoned the House of Commons to re-assemble on September 30th.

Waterproofing Cloth Electrochemically.—Mechanically impregnating cloth with rubber, resins, waxes, or gums renders the fabric both water and air proof. Chemical impregnation with a substance that is insoluble in water overcomes the air circulation difficulty, but cloth so treated cannot be washed vigorously or dry cleaned, the aluminium soap coating being soluble in benzine. In 1907 Mr. Alfred O. Tate realised that the principle involved was one of electro-osmosis and the essential features of his first machine have been retained in all the subsequent improved models. There is the graphite electrode, the cathode over which a solution of aluminium acetate is permitted to flow, an aluminium anode, and a heavy woollen pad completely enveloping the latter—a distinctive characteristic of the invention, making it possible to attain evenly distributed waterproofing. A machine produced in 1916 was installed in Montreal for waterproofing the fabric used in the Canadian aviation uniforms. On a military basis it was satisfactory, but its low speed of operation—one yard of cloth per minute—made it useless on a normal commercial basis. The controlling factor was the time of contact between cloth and electrodes, and to speed up the travel of the cloth without shortening the time of contact, the roll electrode was abandoned for the plate. This change led to the present type of machine, in successful commercial use at the Tate plant in Cranston, Rhode Island, U.S.A., which has a waterproofing capacity of about 36,000,000 yards per annum.

Wool and silk fabrics are waterproofed on a machine with two sets of electrodes, cotton fabrics on one with four sets. The extra electrodes are necessitated by the structure of the cotton fibre, less easily penetrated by the chemicals than the wool or silk. The cloth passes first through a bath of sodium oleate, a very dilute solution being used. The fabric dips into the bath in an endless band, the excess solution being squeezed out as it passes between hard rubber rolls. The treatment is repeated, when the cloth is ready for the electrodes. So far as the chemicals used in the later steps are concerned, the process is identical with the unsatisfactory ones which it is intended to supersede; the difference is the more thorough penetration of the material under the electrolytic action.

The electrodes are vertical; the anode is built of aluminium bars, one above another and bolted together in a suitable frame, over which the woollen pad mentioned above is secured. The cathode is also vertical, and consists of graphite bars fitted loosely into metal guides and held in position by springs, which allow a delicate regulation of the pressure against the cloth as it moves through the machine, making it possible to vary the pressure according to the character of the fabric being treated, and to pass a seam through the machine without stopping the apparatus. Each graphite bar is provided with a feed trough, through which the solution of aluminium acetate is fed and trickles down through perforations, wetting the cloth, the current passing from the graphite cathode through the cloth to the positive aluminium electrode. The essential feature is simplicity and the ease with which the treatment is effected.—*Scientific American*.

Educational.—MUNICIPAL COLLEGE OF TECHNOLOGY, MANCHESTER.—The College authorities have issued a prospectus for the 1924-25 session containing full particulars of university degree, certificate, and other courses in engineering, applied chemistry, textile industry, building, &c. The laboratories and their equipment are fully described.

LOUGHBOROUGH COLLEGE.—The Calendar for the session 1924-25 sets forth exhaustive details of the various engineering and allied courses which are available at the college, and the amenities which students enjoy are given a great deal of attention. The views of the institution are particularly attractive.

UNIVERSITY COLLEGE, LONDON.—The new session will open on Monday and Tuesday next, when students of the Faculty of Engineering will be received by the Provost, the Dean of the Faculty and the Sub Dean. The new engineering laboratories are now available for use.

ROYAL TECHNICAL COLLEGE, GLASGOW.—The impending retirement of Dr. Magnus Maclean and the appointment of the new Professor of Electrical Engineering presented an opportunity for supplementing the large electrical equipment with up-to-date plant, and an appeal was recently made to British firms through the Council of the British Electrical and Allied Manufacturers' Association. Prof. S. Parker Smith, on behalf of the College, has expressed his thanks to the Association for its immediate and sympathetic response to the appeal, and to its members for their very generous gifts of modern machinery and apparatus in wide variety. The following are the names of the chief donors:—The British Electric Transformer Co., Ltd., the British Thomson-Houston Co., Ltd., Electric Control, Ltd., the English Electric Co., Ltd., Electromotors, Ltd., Messrs. Ferranti, Ltd., the General Electric Co., Ltd., the Macfarlane Engineering Co., Ltd., Messrs. Mavor and Coulson, Ltd., the Metropolitan-Vickers Electrical Co., Ltd., Messrs. Bruce Peebles & Co., Ltd., and Messrs. Allen West & Co., Ltd. Valuable gifts of mining apparatus were also received from Messrs. Reyrolle, Ltd., Messrs. Ferguson, Pailin, Ltd., and Mr. George Ellison, at the beginning of last session, which enabled the mining students attending the College to obtain experience with the types of switchgear they would be called upon to use later. The new machinery and apparatus will enable the College to modernise the laboratories and to relieve congestion by having fewer men in each group and by spreading a larger number of machines over increased floor area.

Manchester's Suggestion Scheme.—Following the practice of a number of large firms, the Manchester Corporation Electricity Department has instituted a "suggestion scheme" by means of which any ideas put forward by employés may be considered and, if thought suitable, adopted and the employés concerned rewarded. The scheme is modelled upon those of the London, Midland & Scottish Railway Company and the Metropolitan-Vickers Electrical Co., Ltd., and arrangements have been made for the award of amounts up to £10 at the discretion of the chief engineer and manager (Mr. S. L. Pearce, C.B.E.), but the Electricity Committee may make larger awards if it considers they are merited by any suggestions which may be acted upon.

The Electrical Trades Benevolent Institution.—As from September 29th, the offices of this Institution will be moved to 98, Grosvenor Road, London, S.W.1.

Appointments Vacant.—The Shanghai Municipal Electricity Department requires the services of an electrical testing engineer (600 taels per month); an assistant to the executive engineer of the power station (700 taels); and an assistant power station chemist (250/300 taels). Tael=3s. An engineer (£470) is wanted by an English railway company in Buenos Aires. Assistant (mains) engineer for the Portsmouth Corporation Electricity Department. Chief wireless operator ($1,500 per annum) for the Government of British Honduras. (See our advertisement pages to-day.)

Midland Electrical Engineers' Ball.—The committee has decided to hold the Midland Electrical Engineers' Ball this season at the Grosvenor Suite, Grand Hotel, Birmingham, on Friday, November 21st. Mr. R. A. Chattock will again act as chairman, and Messrs. W. A. Collard, Daimler House, Paradise Street, Birmingham, and W. Y. Anderson, 14, Dale End, Birmingham, as joint hon. secretaries. Tickets, one guinea each, may be obtained from any of these gentlemen.

Illuminating Open Spaces.—Last week the North Gardens at the British Empire Exhibition were illuminated with Mr. John I. Hall's system of projectors, which gives an excellent distribution of light, whilst avoiding any marked effect of "glare." The lighting fittings are mounted on the colonnades, and number 16.

Lightning.—The co-ordination of the research and observations that have been made of lightning and its effects on transmission lines is the object of a paper in the August issue of the A.I.E.E. *Journal*, by Mr. F. W. Peek, Junr., of the American General Electric Co., whose conclusions are as follows:—The voltage of a severe lightning flash is probably of the order of 100,000,000. The current may be 78,000 amperes and the stored energy 13,500 kW/sec. The discharge is usually non-oscillatory and often takes place in a few microseconds. Most lightning disturbances on transmission lines are steep-wave-front impulses that occur by electrostatic induction. There may also be impulses of slanting-wave-front and damped oscillations. The lightning arc-over of insulators is always higher than for 60 cycles, and is not greatly affected by moisture. The usual induced voltage is probably below 1,000 kV. The voltage increases almost directly with the height of the line. The maximum possible voltage can be estimated by multiplying the maximum gradient of 100 kV/ft. by the height of the line in feet. A lightning wave travels over the line and is dissipated to a considerable extent by corona loss. When it strikes an inductance or the end of the line it increases in value and is reflected. If the inductance is not shunted by resistance, high values of voltage may be built up. When breakdown occurs there is a damped oscillation at the comparatively low frequency of the natural period of the line or some section of the line. Switching surges and other high-voltage disturbances that occur on transmission lines are damped oscillations and always require a higher voltage to cause insulator flash-over than 60 cycles. Persistent or continuous undamped oscillations at high voltage cannot exist on transmission lines because of the enormous losses. This also applies to damped oscillations of high train frequency. A high-frequency oscillation requires an arc. It is, therefore, a secondary disturbance following a breakdown caused by lightning, dirt, or some defect. Oscillations are not serious on grounded neutral systems.

A single ground wire when properly installed under favourable conditions reduces the induced lightning voltage to 48 per cent. of that without a ground wire; for two ground wires the reduction is to 34 per cent., while for three ground wires it is to 24 per cent. The reduction is the same for isolated and grounded neutral systems. The ground wire is apparently not effective in a dry country unless grounds can be made in conducting soil. Induced lightning voltages are higher in a dry country than in a wet country. The effectiveness of a ground wire decreases as the resistance or inductance of the ground connection increases. The ground wire is also a good protection against direct strokes.

Insulating inductive apparatus to withstand lighning voltages is a greater problem than simply adding insulation. Shields to prevent localisation of stress are important and function in a manner somewhat similar to the ground wire. The indications are that a 220-kV line with a ground wire should be almost free from lightning troubles. It cannot be said that there is any definite voltage where immunity begins,

since the unusual may always happen. The danger becomes less and less with increasing operating voltage. The extent to which protection should be used is a combined engineering and economic problem. The economic problem is to balance the cost of insurance against the value of better service and reduced liability of trouble.

Institution Notes.

Institution of Mining Engineers.—The annual general meeting is to be held at the British Empire Exhibition on October 2nd and 3rd. Special railway concessions have been secured, and vouchers can be obtained from the Secretary, Cleveland House, 225, City Road, E.C.1. It has been decided not to hold a dinner this year.

Sir John Cadman will take the chair at the opening of the meeting, and will induct as his successor as president Dr. J. S. Haldane. The latter's presidential address will deal with "The Values for which the Institution Stands."

Institution of Heating and Ventilating Engineers.—A competition was arranged by the Institution of Heating and Ventilating Engineers early in the year to encourage education in the industry. The result has now been issued by the Council. Interest seems to have been awakened in different parts of the world, and the "Lumby" Premium, £10 10s., presented by Messrs. Lumby's, Ltd., of Halifax, was secured by an American, Mr. V. Nekrassoff, of Philadelphia, U.S.A. The "Sirocco" Premium, £10 10s., presented by Messrs. Davidson & Co., Ltd., was awarded to Mr. Victor Matthews, of Bristol, and the "Preston" Premium, £5 5s., presented by Mr. J. R. Preston, of Messrs. Mumford, Bailey & Preston, Ltd., London, was awarded to Mr. H. A. Stirzaker, of London.

Junior Institution of Engineers.—The 1924-25 session will be opened on October 3rd with a lecture on "Explosions, Terrestrial and Celestial," by Prof. A. W. Bickerton, A.R.S.M. The chair will be taken by Prof. H. J. Spooner, M.I.Mech.E. A full programme of papers and lecturettes has been prepared for the year, covering a variety of subjects of present-day interest. On October 10th a paper entitled "The Design of Static Sub-stations" will be read by N. Thornton, A.M.I.E.E., and on October 17th a lecture on "High Voltage Electric Oscillations" will be delivered by R. P. Howgrave-Graham, M.I.E.E. Lecturettes to be delivered in October are "Powdered Fuel," by F. F. Evans, on the 24th, and "Audio-frequency Transformers," by H. J. N. Riddle, on the 31st. Further particulars of these meetings and tickets of admission may be obtained from the Secretary, 39, Victoria Street, S.W.1.

Our Personal Column.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.

Hammersmith Borough Council Establishment Committee, on the recommendation of the Electricity Committee and the Electricity Joint Board recommends that Mr. W. WILCOCKS, engineer-in-charge, and Mr. J. DAY, assistant mains engineer, be appointed district mains superintendents at a salary of £507 per annum, and that the matter be further considered by the Council at the expiration of 12 months; and that Mr. C. MORRIS, meter assistant, be appointed meter inspector and tester and be placed upon the technical staff at a salary of £233 per annum.

MR. J. BAGSHAWE, late of the British Westinghouse Co. and Messrs. Fuller's United Electric Works, has joined Messrs. Donovan & Co. as outdoor representative.

The Mayor-Elect of Salford, Alderman BILLINGTON, J.P., is in business as an electrical engineer in Chapel Street, Salford, in which he succeeded his father. He has been a member of the Town Council since 1906.

The Board of Trade has appointed Mr. E. R. EDDISON, C.M.G., to be Comptroller of the Companies Department, in succession to Mr. H. M. Winearls, who is retiring after 31 years' service.

Coventry Education Committee has appointed Mr. J. E. BENNETT, of Erith, as head of the Electrical Engineering Department at the Technical Institute, at a commencing salary of £450 per annum.

MR. W. G. WICKHAM, Senior Trade Commissioner in South Africa, is at present in this country on an official visit and will be in attendance at the Department of Overseas Trade during October for the purpose of interviewing, by appointment, British manufacturers and merchants interested in export trade to South Africa. Those interested should write to the Comptroller-General, Department of Overseas Trade, 35, Old Queen Street, S.W.1 (Reference 5457 T.G.).

MR. J. A. VICE, assistant resident engineer at the Barton station (Manchester Corporation), has resigned to take up the position of resident engineer at the County of London Company's Barking station. Mr. S. A. RUSSELL has been appointed to the vacancy.

MR. JOHN BRUCE, late Tests Engineer, Dalmarnock Power Station, Glasgow Corporation Electricity Department, has been appointed boiler-house superintendent at the new Barking generating station of the County of London Electric Supply Company, Ltd. Mr. Bruce had been in the service of the Glasgow Corporation Electricity Department from March, 1912, and had held various positions on the generating staff. On his resignation he was presented by the staff with a suitably inscribed chronometer stop watch, a case of pipes, and a tobacco pouch. During the war Mr. Bruce saw considerable service in destroyers and submarines, and in 1918 was decorated for distinguished service. Our readers are aware that a number of articles from Mr. Bruce's pen on "Boiler

Mr. John Bruce, A.M.I.E.E.

House Practice" have recently appeared in the ELECTRICAL REVIEW, and that he is the author of a book issued a short time ago on "Power Station Efficiency Control."

SIR CHARLES PARSONS, Sir ERNEST RUTHERFORD, and Professors COKER and DONNAN, arrived at Philadelphia last week for the celebration of the centenary of the Franklin Institute.

MR. R. OSWALD BALDWIN, borough tramway manager at Exeter, has resigned his position.

Obituary.—MR. T. LINDSAY.—The death took place on September 16th, after an operation, of Mr. Thomas Lindsay, Power Station Superintendent of the Coventry Corporation Tramways department. He formerly held positions in China and Japan.

Wills.—The late Sir G. T. BEILBY, F.R.S., left £163,690 gross and £154,249 net personalty.

New Companies Registered.

Gray Bros. (Newcastle), Ltd. (200,499).—Private company. Registered September 19th. Capital, £3,000 in £1 shares. To adopt an agreement with T. C. Gray, G. J. R. Gray, and G. M. Wheater, and to carry on the business of electrical engineers and contractors formerly carried on by them at 149, Pilgrim Street, Newcastle-on-Tyne, and at 11, Elevet Bridge, Durham, and that of electricians, manufacturers of, and dealers in wireless apparatus, motor-cars, wagons, and other vehicles, &c. The directors are:—T. C. Gray, 11, Salter's Road, Gosforth, Northumberland, electrical engineer; G. J. R. Gray, 3, Race Street, Sandyford Road, Newcastle-on-Tyne, electrical engineer; G. M. Wheater, "Yearsley," Whitley Bay, Northumberland, merchant. Qualification, £100. Remuneration, two guineas each per board meeting attended. Secretary: G. B. Jameson, 14, The Poplars, Gosforth. Registered office: 70, Pilgrim Street, Newcastle-on-Tyne.

Westfield Wireless, Ltd. (200,467).—Private company. Registered September 17th. Capital, £1,000 in £1 shares. To carry on the business of manufacturers of and dealers in instruments, apparatus, accessories, and all materials connected with radio or wireless telegraphy and telephony, &c. The directors are:—J. Carr, Dyneley House, Skipton; Miss Elizabeth Carr, Dyneley House, Skipton; Mrs. Margaret Carr, Dyneley House, Skipton. Solicitor: H. Duxbury, 63, High Street, Skipton. Registered office: 109, Westfield Road, Leeds.

Bower Electric (Bristol), Ltd. (200,424).—Private company. Registered September 15th. Capital, £5,000 in £1 shares. To carry on the business of electrical engineers, manufacturers of and dealers in all kinds of electrical apparatus, machines, accessories and goods, wireless instruments, &c. The directors are:—J. B. Bower, 17, Church Lane, Merton Park, S.W., engineer; E. B. P. Davis, 107, Adelaide Road, N.W.3, engineer; S. E. Wilmot, 29, Cambridge Street, Hyde Park, W.2, engineer. Qualification of first directors: 1 share. Remuneration: £100 each per annum. Solicitor: G. H. Olley, 11, Queen Victoria Street, E.C. Registered office: 15, Grape Street, Shaftesbury Avenue, W.C.

C. B. Elliot, Ltd. (200,413).—Private company. Registered September 15th. Capital, £2,000 in £1 shares. To acquire the business of a manufacturer of electric batteries and lamps carried on by C. B. Elliot at Mid Kent Works, Southey Street, Penge, S.E. The directors are:—C. B. Elliot, 17, Raymond Road, Elmers End, Kent, electrical engineer (permanent); W. G. Bate, 35, Bedford Row, W.C.1, solicitor. Solicitors: Bate & Co., 35, Bedford Row, W.C.1. Registered office: Mid Kent Works, Southey Street, Penge, S.E.

Car Lighting and Ignition Co., Ltd. (200,441).—Private company. Registered September 16th. Capital, £5,000 in £1 shares. To adopt an agreement with A. W. Iles and to carry on the business of electrical, motor and general engineers, and contractors, manufacturers of and dealers in electrical, magnetic, galvanic and other apparatus, &c. The first directors are:—R. E. Bridge, 19, Burnby Road, Alum Chine, Bournemouth (chairman); A. W. Iles, 54, Seamoor Road, Bournemouth, electrical engineer; R. F. Seward, "Carisbrooke," Studland Road, Bournemouth, building contractor; J. H. Wolfe, Chine Cote, Studland Road, Bournemouth, photographer. Qualification: £100. Remuneration: £20 each per annum. Secretary: J. H. Wolfe. Solicitors: Mooring, Aldridge & Haydon, Westover Chambers, Bournemouth. Registered office: 54, Seamoor Road, Bournemouth.

Lazenby's (North Ferriby), Ltd. (200,480).—Private company. Registered September 18th. Capital, £2,500 in £1 shares. To acquire the business of an electrical and general engineer and tool maker carried on by T. Lazenby at North Ferriby. The subscribers (each with one share) are:—T. Lazenby, 13, Marine Avenue, North Ferriby, engineer; A. Kirby, 37, Beverley Road, Hull, chartered accountant's manager. The subscribers are to appoint the first directors, who shall be permanent. Qualification: £100. Solicitor: W. Gilfoy, 3, Parliament Street, Hull.

J. W. Morrish & Son, Ltd. (200,477).—Private company. Registered September 18th. Capital £2,000 in £1 shares. To acquire the business of an electrical engineer, plumber and ships' plumber carried on by J. W. Morrish at Middlesbrough. The directors are:—J. W. Morrish, 444, Linthorpe Road, Middlesbrough, plumber and electrician (permanent); C. J. W. Morrish, 45, Rockcliffe Road, Middlesbrough, electrician. Qualification: £5. Remuneration as fixed by the company. Solicitor: H. Outhwaite, Prudential Chambers, Middlesbrough.

Official Returns of Electrical Companies.

Bordesley Electrical Accessories Co., Ltd.—Mortgage dated September 2nd, 1924, to secure £500, charged on 162, High Street, Bordesley, Birmingham, right of way, &c. Holders: Lycett Saddle and Motor Accessories Co., Ltd., Bromley Street, Birmingham.

Van Raden & Co., Ltd.—First mortgage debenture dated September 5th, 1924, to secure £1,200, charged on the company's undertaking and property, present and future, including uncalled and unpaid capital. Holders: Westminster Bank, Ltd.

Electrical Insulating Composition Co., Ltd.—Debenture dated September 10th, 1924, to secure £1,000, charged on the company's property, present and future, including uncalled capital. Holders: F. V., Ltd., 31, Quay Street, Manchester.

H. Maguire, Ltd.—R. W. Lofthouse, of 1, High Street, Pell, ceased to act as receiver or manager on September 2nd, 1924.

Stamford Engineering Co., Ltd.—R. K. Crane, of Cathedral House, Paternoster Row, E.C., was appointed receiver on September 13th, 1924, under powers contained in first debentures dated June 28th, 1922.

Reading Electric Supply Co., Ltd. (35,651).—Return dated April 24th, 1924. Capital, £52,200 in £1 shares. 152,125 shares taken up. £117,775 paid. £4,350 considered as paid. Mortgages and charges, £98,000.

Electric Light Insurance & Maintenance Co., Ltd. (80,801).—Return dated February 4th, 1924. Capital, £5,000 in £1 shares. 1,255 shares taken up. £1,257 10s. paid, including £2 10s. paid on 50 shares forfeited. Mortgages and charges, £1,830.

Huntalite, Ltd. (81,387).—Return dated March 12th, 1924. Capital, £2,000 in £1 shares. 1,800 shares taken up. £1,500 paid. £50 considered as paid. Mortgages and charges, nil.

Para Electric Railway & Lighting Co., Ltd. (85,368).—Return dated March 31st, 1924. Capital, £780,000 in 300,000 preference and 240,000 ordinary shares of £1 each. 325,000 preference and 300,000 ordinary shares taken up. £25,040 paid on 25,000 preference and 40 ordinary shares. £80,960 considered as paid on 300,000 preference and 300,960 ordinary shares. Mortgages and charges, £599,368.

St. James' and Pall Mall Electric Light Co., Ltd. (26,015).—Return dated March 11th, 1924. Capital, £300,000 in 40,000 ordinary and 20,000 preference shares of £5 each. All shares taken up. £278,250 paid. £1,750 considered as paid. Mortgages and charges, £150,000 3½ per cent. debenture stock.

Electrico, Ltd.—F. G. Wheatley, of 102, High Street, Poole, Dorset, was appointed receiver and manager on September 12th, 1924, under powers contained in mortgage debentures dated March 26th, 1924.

City Notes.

Prospectuses.

The Foundation Company.—A statement of the details of this company was advertised in the daily Press on September 20th, not inviting subscriptions for shares, but purely in order to comply with Stock Exchange Regulations. The company was registered here in 1922 as a private company, and converted into a public company in December, 1923. It acquired from the Foundation Company, of New York, the goodwill of its business in Great Britain and the British Dominions, other than Canada, for 100,000 ordinary shares of £1 each. The total share capital is £250,000. The directors are: A. W. Tait, F. Remington (U.S.A.), Sir Chas. Davidson, J. W. Doty, and W. Rutherford (managing director). Our readers are already aware of the fact that the company engages in engineering and contracting operations.

Melbourne and Metropolitan Tramways Board.—The Commonwealth Bank of Australia has been offering £700,000 5 per cent. stock, 1944, at 98 per cent. on behalf of the above board. The money is to be used for the conversion of the cable trams to electricity and in connection with the general scheme for the development of the tramway system of the metropolitan area of Melbourne.

The Swiss Bank for Electrical Undertakings.—The accounts of the Bank für Electrische Unternehmungen, of Zurich, including the balance forward, show a surplus of 4,170,000 fr. for 1923-24, as compared with 3,000,000 fr. in the previous year. It is proposed to pay a dividend at the rate of 7 per cent. on the "A" and "B" shares, and transfer 250,000 fr. to a special reserve fund.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 109:—

Aldershot and District Traction Co.—75,000 shares of £1 each, fully paid, Nos. 1 to 75,000.

Automatic Telephone Manufacturing Co., Ltd.—140,000 new ordinary shares of £1 each, issued at 21s. 6d., partly and fully paid, Nos. 360,001 to 500,000.

Melbourne and Metropolitan Tramways Board.—£700,000 5 per cent. stock, 1944, issued at 98 per cent., partly paid and fully paid.

Wellman Smith Owen Engineering Corporation.—At an extraordinary meeting on September 22nd it was decided to capitalise £85,000 of the reserve fund and distribute it in the proportion of one £1 share to every two held by the shareholders.

French Company.—*La Société des Accumulateurs Electriques (Anciens Etablissements Alfred Dinieu)*, of Paris, is increasing its capital to the extent of 2,000,000 fr. by the issue of 20,000 shares of 100 fr. nominal, which are being offered for subscription at 115 fr. each.

Belgian Company.—*La Compagnie Electrique Anversoise*, of Antwerp, reports a net profit of 3,589,978 fr. for the year ended June 30th last, as compared with 3,635,731 fr. in the preceding 12 months.

Asia Minor.—The report of the *Société Générale de Tramways Transports et d'Electricité*, of Smyrna, for the year ended May 31st shows a net profit of 90,865 fr., as compared with 109,677 fr. in the preceding 12 months.

Parker, Winder & Achurch, Ltd.—Dividends at the rate of 6 per cent. on the preference shares and 5 per cent. on the ordinary shares have been declared for the six months ended June 30th.

Direct Spanish Telegraph Co., Ltd.—The interim dividend on the preference shares, at the rate of 10 per cent., is payable on October 1st. The ordinary shares will receive a dividend of 4 per cent., free of tax, on the same date.

Bruce Peebles & Co., Ltd.—A dividend at the rate of 7½ per cent. has been declared on the participating preference shares for the half-year ended June 30th last.

Midland Electric Corporation for Power Distribution, Ltd.—An interim dividend at the rate of 10 per cent. per annum has been declared on the ordinary shares.

Electric Supply Corporation, Ltd.—Dividend at the rate of 8 per cent. per annum on the ordinary shares.

Northern General Transport Co., Ltd.—An interim dividend on the ordinary shares at the rate of 2½ per cent. has been declared.

Sir W. G. Armstrong, Whitworth & Co., Ltd.—An interim dividend of 6d. per share (2½ per cent.) has been declared on the ordinary shares, as in 1923.

Rangoon Electric Tramways & Supply Co., Ltd.—The directors have declared an interim dividend of 8 annas per share upon the ordinary shares.

Hendon Electric Supply Co., Ltd.—An interim dividend of 5 per cent., free of tax, has been declared on the ordinary shares.

Folkestone Electricity Supply Co., Ltd.—A dividend at the rate of 8 per cent. is being paid on the ordinary shares for the half-year.

Stocks and Shares.

MONDAY EVENING.

CITY gossip is busy with talk of a possible General Election in the early winter. The speculations, however, fail to affect the general strength of Stock Exchange markets. Investment securities are steadily rising in price, and the abstention from new issues which has been a notable feature of the last six weeks is proving its value in directing money into existing stocks and shares. Rises in Mexican Utilities provide an outstanding feature in the electrical lists this week. A recovery in Metropolitans stands out as the result of the expectation that the Exhibition at Wembley will be re-opened, after all, next year. A good deal of general business is passing in the markets, and the industrial sections are receiving most of the attention, outside purely investment stocks.

The list of London electricity supply shares keeps its prices without showing any special movement, nor is there likely to be much development, either up or down, during the next month. Interest is arising in the provincial, colonial and foreign supply companies' shares, possibly because there are more of these obtainable, and investors prefer to await the end of October before doing anything in the shares of the London undertakings. Some of the shares in the companies which operate outside the London group, the prices of which are not included in our weekly lists, may be usefully set out. We append a short table of shares in various electrical companies, supply, transport and manufacturing, with a view to giving an idea of what can be obtained in this particular section :—

Ordinary share.	Price.	Yield.	Dividends usually paid.
Brush Elec. Engineering ...	21 0	9 10 6	April
Calcutta Elec. Supply	31 0	7 2 0	M. & N.
Cape Elec. Trams	18 9	6 7 6	net J. & D.
Egham & Staines Elec. ...	20 0	7 10 0	March
Lancashire Elec. Lt. & Power	25 3	5 19 0	May
Metropolitan-Vickers Elec. ...	20 0	8 0 0	April
Scottish Power	23 3	6 18 0	March

The yield is calculated on the dividend paid for last year.

Metropolitan Consolidated stock, after a dip to 75¾, recovered to 77, upon what seemed to be an authoritative statement to the effect that the Exhibition will be re-opened in 1925. Districts, however, fell back to 50½, and the stocks and shares of the Underground Electric Railways of London are dull, there being very vague talk of a possible new issue of capital. It would certainly appear likely that fresh money will be required in the near future for carrying out the important extensions which the Underground Company has in hand. The re-built City and South London line is to be opened in the course of the next few weeks, and, although money was raised for this work in advance, it is not improbable that more capital may be required for further extensions.

London traction issues are still attracting attention, and a further rise of a point lifted London United Tramways 4 per cent. debenture stock to 55½; the company's preference shares changed hands the other day at 4s. 3d. London and Suburban Traction preference remain at 8s. In the case of this company, a bargain was marked in the ordinary shares the other day at 1s. each.

The chief movements of the week in our lists are those in Mexican Light & Power descriptions. The Common shares have risen 2, the preferred 5, the first debenture 2½; the second debentures at 48½ are 2 up. Pachuca debentures are better at 61½, and Mexico Tramway firsts at 68, and the seconds at 48¼ both show a gain of 2 points. Manila Electric Railway and Light at 118 is 4 points up. Brazilian Tractions are unchanged at 55 and other stocks in the foreign group display little variation.

St. James' and Pall Mall ordinary, with a fall of 5s. to 12½, are the only shares in the London list that have varied since a week ago. Several provincial shares, however, are better. Newcastle-on-Tyne ordinary at 21s. 3d. are 1s. 9d. to the good. Folkestones at 33s. 9d. are 1/16 harder and Bournemouths have a small gain at 48s. The change-over from summer to Greenwich time, which took place last Sunday morning, has not had its usual effect of drawing investment attention to electric lighting shares.

Great Northern Telegraphs continue their improvement, and show their regular rise of 5s. at 28¾, at which price there are buyers. Indo-Europeans, nominally 32½, can be bought at 10s. or a pound cheaper. Eastern ordinary fell back a point, and stock changed hands at 160½. Westerns are ½ down at 15⅞ and Globe ordinary eased off to 17½. The cable group is dull as a whole, the reason being that expectation looks for net earnings in respect of the current year to show a falling off. Meanwhile, however, it is worth noticing that the companies are all maintaining their usual quarterly dividends, which, as regards the Eastern Extension, Eastern Telegraph, Globe, and Western Telegraph, are 2½ per cent. actual, free of tax, in each case. Marconis keep in the neighbourhood of 32s. 6d., though mild optimism is stirred by the latest developments in wireless.

The iron and steel group is heavy, and engineering shares suffer with the rest. Babcock & Wilcox have dropped to 46s. 3d. The market as a whole had been very weak until the announcement of the usual interim dividend on Armstrongs, which served to rally prices to some extent, Armstrongs themselves recovering to 14s. 6d. and Vickers being also a little harder at 8s. 6d. India Rubber shares came to market after their recent rise, reacting to 16s. 3d., though at this price buyers appeared and the tendency of the market improved. Enfield Cables are steady at 45s. and the preference at 24s. General Electric "B" preference at 22s. 6d. are a few pence lower. The rubber share market is decidedly harder. The statistical position improves with every week, stocks on hand being steadily diminished. American manufacturers are evidently running short of stock. The rubber share market has taken on a fresh lease of life, and, although it frequently glances back, the tendency, on balance, is for its prices to advance. Generally speaking, there is a good deal of business doing amongst industrial shares.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom. £	Dividend. 1922.	Dividend. 1923.	Price Sept. 23, 1924.	Rise or fall.	Yield. p.c.
Brompton Ordinary	1	12	10	87/-	—	*£5 6 1
Charing Cross Ordinary	1	14	14½	2⅞	—	7 3 0
do. do. do. 4½ Pref.	1	4½	4½	17/6	—	5 2 10
Chelsea	1	10	13	34/3xd	—	6 12 7
City of London	1	15	15	46/3	—	6 9 10
do. do. 6 % Pref. ...	1	6	6	23/-	—	5 2 9
County of London	1	10	15	46/-xd	—	6 10 4
do. do. 6 % Pref. ...	1	6	6	23/-xd	—	5 4 4
Edmundson's Ordinary	3	7	7	5	—	4 4 10
do. 6 % Pref.	5	6	6	5½	—	5 9 1
Kensington Ordinary	5	13	14	9⅞	—	7 9 4
London Electric	1	10	10	90/6	—	6 11 4
do. do. 6 % Pref. ...	5	6	6	5½	—	5 14 3
Metropolitan	1	8½	10	1⅛	—	5 13 6
do. 4½ % Pref.	1	4½	4½	17/-	—	5 6 0
Newcastle-on-Tyne Ordinary ...	1	2½	6	1/3	+1/9	5 13 0
do. 5 % Pref. ...	1	5	5	17/-	—	5 17 6
do. 7 % Pref. ...	1	7	7	25/-	—	5 12 0
Notting Hill 6 % Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6 % Pref. ...	1	6	6	1⅛	—	5 6 8
Urban Ordinary	1	—	4	19/3	—	4 4 8
do 6 % Pref. ...	1	5	6	1	—	6 0 0
St. James' and Pall Mall ...	5	14½	17½	12½	— ½	7 4 5
South London	1	11	15	43/3	—	6 18 7
South Metropolitan Pref. ...		7	7	1⅛xd	—	5 13 0
Westminster Ordinary	5	12	15	10	—	7 10 0
Whitehall Elec. Invst. 7½ % Pref.	1	7½	7½	19/9	+3d.	7 11 10

HOME RAILS.

Central London Ord. Assented Stock	4	4	69½	—	5 15 2
Metropolitan ... ... „	8½	4	77	+ ½	5 4 0
do. District ... ... „	3	3½	50½	—1	6 18 8
Underground Electric Ordinary	10	Nil	Nil	2⅛	— ⅛	Nil
do. do. "A" ...	1	Nil	Nil	7/6	—6d.	Nil
do. do. Income Bonds	5	6	96	—	*6 5 0

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref. ... ... Stock	6	6	10⅛	—	5 15 5
do. Def. ... ... „	1½	1½	23⅞	—	6 6 4
Chile Telephone	5	6	6	5⅜	—	5 11 7
Cuba Sub. Ord.	10	7	7	7	—	10 0 0
Eastern Extension... ... „	10	10	10	16½	—	6 4 0
Eastern Tel. Ord. ... ... Stock	10	10	162½	—1	6 3 1
Globe Tel. and T. Ord.	10	10	10	17½	— ½	5 15 8
do. do. Pref.	10	6	6	11½	—	5 6 10
Great Northern Tel.	10	24	22	28¾	+ ½	7 13 0
Indo-European	25	7	7	32½	—	*5 6 1
Marconi	1	15	10	1⅝	—	6 1 3
Oriental Telephone Ord.... ...	1	12	12	1⅝	—	*8 3 0
United R. Plate Tel.	5	8	8	6¾	— ⅛	*5 18 6
West India & Panama	10	Nil	Nil	1/-	—	Nil
Western Telegraph	10	10	10	15⅞	— ⅛	6 6 1

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref....	5	12½	5½	8⅞	—	8 0 0
do. do. 2nd Pref. ...	5	5½	6	3½	—	9 4 8
do. do. 5% Deb. ... Stock	5	5	73½	—	6 16
British Electric Traction Ord. ... „	5	6	94½	+1	6 7 0
do. do. 6% Pref. ... „	6	6	101½	—	5 18 3
Brazil Traction 100	4	4	55	—	7 5 6
Brit. Columbia Elec. Rly. Pcc. Stock	5	5	87½	—	5 14 3
do. do. Preferred „	5	96/-	84½	—	*5 13 6
do. do. Deferred „	5	129.5	105½	—	*6 3 3
do. do. Deb. „	4½	4½	81½	—	5 4 4
Lond. & Sub. Trac. 5 % Pref. ...	1	5	2½	8/-	—	6 5 0
London United Tram. Deb. ... Stock	4	4	55½	+1	7 4 2
Mexico Trams. 5% Bonds ...	—	Nil	5	68	+2	7 7 1
do 6% Bonds ...	—	Nil	Nil	48½	+2	Nil
Mexican Light Common ...	100	Nil	Nil	2⅛	+2	Nil
do. Pref.	100	Nil	Nil	53	+5	Nil
do. 1st Bonds ...	—	5	5	65	+2½	7 13 10

MANUFACTURING COMPANIES.

Babcock & Wilcox...	1	20	12	46/3	—9d.	*5 4 0
British Aluminium Ord.... ...	1	5	5	24/6	—	4 1 8
British Insulated Ord.	1	15	15	55/9	—	5 7 6
Callenders	1	15	15	55/-	—	5 9 1
do. 6½ Pref....	1	6½	6½	23/3	—	5 11 10
Crompton Ord.	1	5	Nil	⅞	—	8 17 10
Edison-Swan	4/-	7½	—	4/9	—	6 0 0
do. „ 5% Deb. ... ... Stock	5	5	71½	—	6 19 10
Electric Construction	1	10	10	1⅛	—	6 19 0
English Electric	1	6	6	17/6	—	5 14 3
do. do. Pref.	1	6	6	1	—	6 3 1
Gen. Elec. Pref.	1	6½	6½	23/-	—	5 13 1
do. Ord.	1	5	5	18/-	—	5 13 0
Henley	1	15	15	55/-	—	5 9 1
do. 4½ Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	10	5	16/3	—6d.	*6 3 1
Met.-Vickers Pref....	2	8	8	2⅜	—	6 14 0
Siemens Ord.	1	5	—	1	—	6 0 3
Telegraph Con.	13	20	20	24½	—	*4 17 1

* Dividends paid free of Income Tax.

The Municipal Tramways Association (Inc.).

Annual Conference at Southport.

THE twenty-third annual conference of the Municipal Tramways Association (Inc.) was held at Southport from September 17th to 19th. It was attended by representatives of 97 British municipal tramway authorities which are members of the Association, and the proceedings were opened by the delivery of the presidential address by the general manager of the Bolton Corporation tramway undertaking, who explained that lack of accommodation alone made it impossible to welcome the Association to Bolton. The delegates, however, were to visit that town on the 19th inst., when they would learn something of the amenities of the largest fine cotton-spinning centre of the world, and some would be interested in one of the newest power stations in the country.

The Mayors of Southport and Bolton gave the Association a civic welcome on Wednesday morning, September 17th, and in the course of a short speech the Mayor of Southport said that tramway managers and authorities generally did not receive the credit from the public which was due to them. When it was remembered that 3,500 million passengers were carried on the tramways every year, that £68,000,000 was invested in the industry, that there was an annual income of £25,000,000, and that 55¼ thousand tons of copper was collected every year in fares, it would be realised what a great work the tramway industry was carrying on. Judging by the smiling faces which he saw around him that morning, it was quite evident that the tramway managers and committees were satisfied that they were doing their best according to their ability. Speaking of Whitley councils, he said he would like to see more co-operation on them, because he was not satisfied with their working at the present time.

The Mayor of Bolton and Alderman Charles Higham (vice-president) expressed thanks for the welcome offered.

Presidential Address.

By JOHN BARNARD, M.B.E.

(*Abstract.*)

During the year the tramway industry has been confronted by continuous and contradictory demands. The clamour for fare reductions is unabated, yet wages (the largest item in tramway costs, and much more than half the total) are more than 100 per cent. over the 1914 figure. During the July public inquiry into wages, emphasis was laid upon the amount contributed in reduction of rates by tramways. In the current year, the sum for that purpose—about £240,000 divided among 18 authorities—is almost equal to the amount by which local taxation is increased by 21 authorities for tramway deficiencies. In two cases at least the contribution to the rate fund is in return for sums drawn from rates in previous years. One of the most striking implications which emerged from the investigation was that, although all parties are agreed that the existing financial burdens upon tramways can no longer be defended, any relief from the cost of road maintenance and the rating of the permanent way, for example, should not be applied to the advantage of the users of tramways, but should provide means for the payment of additional wages only. On one point, at least, we were on common ground. The speaker for the men declared that tramways were the most efficient slum-destroyer he knew of. In the ultimate issue, "Social Service" was the claim upon which the men relied, and they deprecated any comparison of their wages with those paid in any other industry.

Two big problems confront tramway authorities; they involve questions of public policy and finance. With regard to competition, it is becoming more and more clear that the only practical and effective solution of this problem will be to place in the hands of one authority the means of passenger transport in their respective districts, both in the interests of economy and efficiency, and not least in those districts where there is a distance of a few miles only separating two or more tramway systems. It would appear that the economical and common-sense thing to do would be for Parliament to confer powers upon the transport authorities concerned to authorise the connection by omnibus services, but in some cases, after the tramway authorities have been refused such powers, they have been granted to private companies to run services over considerable lengths of existing tramways for the purpose of covering the short intervening distances between two operating tramways.

With regard to the financial burdens, we are in a real dilemma. At present the Roads Fund is solely a local authorities fund, and it is because there is no solution of the problem along that line which would not deprive local authorities of funds now apportioned amongst them that it is impolitic to pursue the subject further under existing circumstances.

In deference to a general desire that each area into which the country is divided for National Council purposes shall have some representation on the governing body of the Association; the Council submits to you a scheme in its report with that end in view. At least, it can be experimented with by consent for a time without interfering with the articles of association.

The year was marred by a strike in the metropolitan area, arising out of conditions which were not equalled in any other part of the Kingdom, in particular as respects the difference between 'bus and tramway men's wages.

That strike placed London outside the scheme of national negotiations. The National Council cannot recognise sectional action, and it declined to ratify the terms upon which the strike was settled. The result found expression in the demand made by the employés on May 16th last for a material increase in wages for the rest of the country, representing an aggregate sum of from £600,000 to £800,000 a year. The year's proceedings of the National Council show that the significant term "no decision" appears with monotonous reiteration, indicating that the Council was rapidly becoming an ineffective instrument for the purpose for which it was designed. Numerous leaders in the commercial world are watching our experiment with the tribunal as a genuine attempt to explore every avenue before an industry is thrown into confusion.

The financial position of tramways in relation to local taxation has swung round completely since pre-war days. In 1913-14, tramways in Great Britain were subsidised by local rates to the extent of £62,600, and contributed £578,019 in relief of rates. In 1922-23 they received £271,339 from local rates and contributed only £150,247, and this, too, notwithstanding the fact that in the cases of 53 municipal undertakings increased fares sanctioned by temporary orders issued under the Tramways (Temporary Increase of Charges) Act, 1920, were in operation. Moreover, it is significant of the effect of increased fares that although the car mileage was increased by nearly 6 per cent. during that year, the gross receipts fell by £1,259,198, or nearly 4 per cent. The ratio of working expenses to receipts was 76.23 per cent., having decreased by 6.38 per cent. during the year; it is, however, still 11¼ per cent. higher than in 1913-14. These facts portend the disappointment of any hope built upon an expectation of a return, generally speaking, to pre-war conditions as respects tramway fares.

One outstanding feature of the policy of tramway authorities deserves special mention. It is the growing emphasis laid on the necessity of making provision for the renewal of wasting assets, and the willingness to comply with it. In 1913-14 £972,423 was set aside in renewals and reserve funds; in 1922-23 the sum was £2,639,868.

With regard to the future generally, it will require the sustained and persistent efforts of tramway committees throughout the country, and of this Association, to grapple successfully with the legion of adverse factors which are thrown across our pathway, not the least of which are the twin forces of costs and competition. Every item on the costs side tends to become standardised, while on the other side there is no standard revenue. We believe that there is not yet any form of street-passenger transport equal to the tramcar for conveying masses of the populace in a shorter time and at less cost.

We must not, however, bury our heads in the sand, and blind ourselves to adjuncts or alternatives in certain circumstances. We must be prepared to inquire into and experiment with any form of transport that may be devised. Doubtless, quick and cheap service will play an important part in the future housing policy of this country.

The PRESIDENT mentioned the fact that Mr. J. M. McElroy (late general manager of the Manchester Corporation tramways, and for many years intimately associated with the Association) was lying very ill, and said that the Council proposed to send him the following telegram:—

"The members of the Association, assembled in annual conference at the Palace Hotel, Southport, have heard with sorrow of your continued illness which deprives them of the pleasure of your intended presence and send a message of cheer and hope in grateful recollection of former years of eminent service to the Association. Courage!"

To this message, Mr. MCELROY later replied, and a paper was then read on the subject of "Tramway Passes," by Councillor A. Digby Willoughby (Hull).

(To be continued.)

Some of the Exhibits at Wembley.

The British Electric Plant Co., Ltd.

(Stand No. 1, Avenues 8 and 9, Bay 5.)

This company has had over 20 years' experience in the manufacture of electrical and turbine pumping plant, and numerous exhibits embodying the most modern developments are to be seen upon the stand. One of the designs on view is the

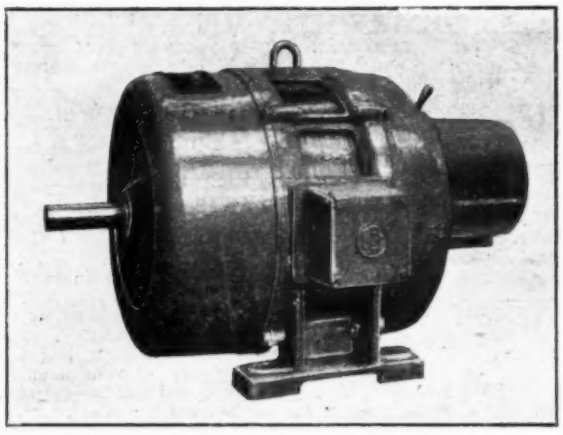


Fig. 201.—A British Electric Plant Co. Totally-enclosed Motor.

company's patent totally-enclosed external-fan-ventilated induction motor, which has been designed especially for use under dusty, wet or inflammable conditions, such as obtain in flour and textile mills and collieries. Two typical machines are shown—one of the slip ring type fitted with brush-raising and short-circuiting gear, designed to deliver 90 h.p. at 750 r.p.m. (fig. 201); and the other of the squirrel-cage pattern, rated for 22 h.p. at the same speed. Both motors are arranged to operate on a three-phase, 50-cycle, 440-V circuit.

In past years the electrical industry has been seriously handicapped by the limitations in the horse-power obtainable from totally enclosed motors. The company has devoted 10 years to research and experiment in this direction, and the outcome of its efforts is that the a.c. motors mentioned above are not appreciably larger than similar machines of the semi-enclosed type. The construction is such that, while the motor is totally enclosed, the stator laminations are slotted in a particular manner from end to end of the core, and external air is forced through the channels so formed, while, at the same time, the essential condition that there shall be no connection between external cooling arrangements and the inside of the machine has been fully complied with. The company is prepared to supply motors of this construction in sizes up to 200 h.p.

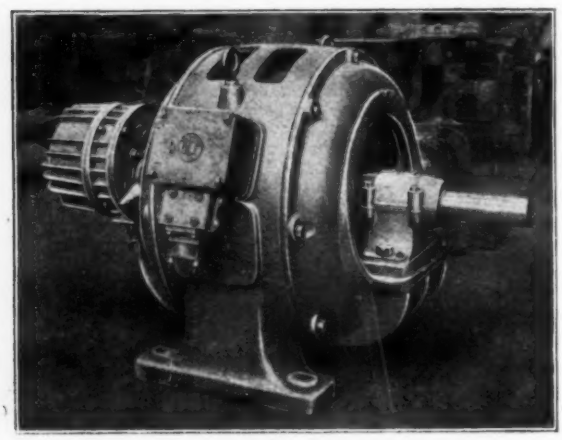


Fig. 202.—B.E.P. 150-h.p. Slip-ring Motor.

An interesting comparison in size has been made by placing one of these motors side by side with another of the open protected type, both motors being rated at the same capacity, namely, 22 h.p. at 750 r.p.m.

A number of other machines of the slip ring type are exhibited, and particular attention is directed to a 150-h.p., 2,000-V, 500-r.p.m., heavy type slip ring motor (fig. 202), which is of the same pattern as some 20 of the same kind which have been installed in a South Wales colliery. In addition to the machines shown on the stand the company manufactures rotary converters, d.c. generators, and alternators up to 1,000 kW capacity.

A number of centrifugal pumps are shown on the stand, direct-coupled to steam turbines and motors. One pump shown has a capacity of 1,000 gallons per minute against a 1,500-ft. head. All metals used in pumps are carefully considered for the different classes of water to be dealt with. The pumps are used for colliery, boiler feed, irrigation, and drainage schemes. The high pressure unit mentioned above will be of particular interest to dock engineers and those connected with high-pressure water supply. It consists of an eight-stage pump running at 1,470 r.p.m., and, as mentioned, is capable of delivering 1,000 gallons against a pressure of 750 lb. Recent improvements in design have enabled such a unit to be incorporated in one pump, whereas these high pressures had previously necessitated the provision of two pumps in series. The saving to the docks engineer, both in capital expenditure and in power costs, is very apparent. A second pump is driven by a 200-h.p. induction motor, and is a six-stage turbine pump capable of delivering 650 gallons per minute against a total head of 700 ft. (fig. 203): it is representative of many stationary pumps supplied for collieries, and industrial concerns generally. The single-stage, double-entry, low-lift centrifugal pump on view will deliver 700 gallons per minute at 1,500 r.p.m. A feature of this machine is the ease of access to the internal parts, impeller, guide vanes, &c. Upon another part of the stand may be seen a smaller pump of the same type. The boiler feed pump shown, which has a duty of 200 g.p.m. against 200 lb. pressure when driven at 3,000 r.p.m., is connected through gearing to a 50-h.p.

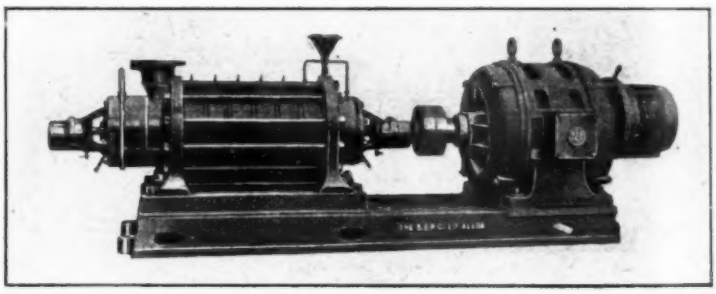


Fig. 203.—A B.E.P. Six-stage Pumping Set.

steam turbine working under a supply pressure of 200 lb. per sq. in.

All the firm's turbine pumps are of the self-balancing type, being provided with hydraulic balance disks which automatically take up the end thrust which is always present in the multi-stage turbine pump. Vertical type motor-driven sinking pumps have been made by this firm for many years past, but it is worthy of note that it has under construction at the moment several of the largest mine-sinking pumps, it is claimed, that have been built in this country.

Vickers Research Building.

The Research Section of the exhibit of Messrs. Vickers, Ltd., consists of a laboratory in which are shown in use some of the scientific apparatus and methods employed in the company's factories. Naturally only a small selection has been made, for the company deals with an enormous range of products in many fields.

A large part of the laboratory is devoted to apparatus used in the production of steel and alloys generally. Furnaces for the experimental heat treatment of steels and for temperature control by pyrometric apparatus, are shown in operation, while in a specially designed electric furnace the hardening and tempering of small components is carried out in an atmosphere of unburnt coal gas to avoid surface oxidation or decarbonisation. The etching and printing of sections cut from ingots and forgings illustrate the method of determining their microscopic structure, and in antithesis to this large scale examination apparatus for the microscopic examination and photo-micrography of steel and other metals demonstrate how the origins of faults are investigated and avoided. A specially designed metallurgical spectroscope enables the presence of nickel and chromium in steel to be detected immediately, thereby solving one of the troublesome post-war problems of the steel industry. Hardness measurements are dealt with by two instruments. The first is the simple Vickers

hardness comparator, a portable instrument for the approximate determination of the Brinell hardness of metals. It is applicable to large or small pieces and the surface to be tested may be at any angle. It is, therefore, extremely convenient for the testing of assembled components, such as tires, axles, stamping dies, automobile components, &c. The second of the two instruments is the Vickers diamond hardness testing machine, in which the test is of the static or indentation type, and the indentor is a specially cut diamond with a pyramid point which produces impressions of geometrical similarity irrespective of size. The impressions made with the diamond pyramid are extremely small, and the load applied does not exceed 50 kg. Therefore, the test is applicable to actual surface conditions, and can be used with great advantage for the testing of finished work including very thin specimens, case-hardened work, &c. A specially designed microscope enables the observer to accurately determine the dimensions of the impression made by the diamond pyramid.

With the Vickers projection microscope the piece for examination is placed on a strong table, and immediately, without adjustment, the magnified image can be seen, brilliantly illuminated, on a ground glass screen placed at a convenient angle for observation, and, if required, a standard photo-micro-transparency can be placed at the side for purposes of comparison.

The instruments for central research include an X-ray spectrograph for the analysis of substances used as anticathodes and for the determination of space lattice structures of crystals, and hence their identification. Prof. Coker's complete photo-elastic apparatus for the determination of stresses and their distribution in structural and machine members is of especial interest.

The control of manufacture of a particular product is illustrated by a group of instruments contributed by the British Lighting & Ignition Co., which are demonstrated as applied in the new B.L.I.C. magneto to the testing of the magnets, the insulation of the coils and the dielectric strength of insulation; while an interesting visible means is provided for detecting "missing" should it be present in the completed magneto.

The exhibit illustrating research on low temperature distillation of coals, lignites, torbanites, and shales consists of a model carbonising plant and a refinery for the treatment of oils therefrom, with recovery of by-products, also samples of the products from the low temperature carbonisation of the same substances. These samples have been produced by special processes evolved in the laboratory of Vickers' oil engineering department, and tested on a commercial or semi-commercial scale. They are specially intended to show the importance and value of the system, whereby an economical use of carbonaceous matter is attained on lines that are becoming every day of increasing importance. A Vickers fusion retort for the low-temperature carbonising of coals, lignites, shales, &c., is also shown.

Miscellaneous exhibits include an optical gauge for the rapid gauging of simple solids of revolution; a strain viewer for detecting stresses in glassware due to imperfect annealing; electrochemical analysis apparatus for the rapid determination of metals by electrodeposition; note-detecting apparatus for tracing unusual notes from high-speed machines such as turbines and alternators; and a Low-Hilger audiometer for visual and photographic observation of sound waves.

Messrs. Richard Hill & Co., Ltd.

(*Stand No.* 190, *Avenue* 2, *Bay* 25.)

This company is exhibiting samples of "Maxweld" electrically-welded steel fabric in varying strengths and spacings. The company manufactures a comprehensive range of different strengths of fabric suited to any set of conditions likely to be met with in reinforced concrete construction. Among the exhibits is a sample of double-layer fabric which has been designed to provide for flexure, contra-flexure and shear stresses, which are met with when slabs are constructed over made-up or unsuitable ground. This has girder-like strength and is applicable to almost any type of construction since it conforms readily to any shape or section or thickness of slab.

A new product in the shape of electrically-welded fabric made from mild steel rods to British Standard Specification is another exhibit. The rods are taken from the rolling mills, and without any further process are manufactured into fabric.

Messrs. Richard Johnson & Nephew, Ltd.

(*Stand No.* 173, *Avenues* 1 *and* 2, *Bays* 7 *and* 8.)

Iron, steel, and copper wire of all kinds is shown on this stand, including wire for electric cables, armatures, and traction. In addition, samples of commutator bars are on view as well as bus bars and copper sections and strips.

The Morgan Crucible Co., Ltd.

(*Stand No.* 258, *Avenue* 4, *Bay* 4.)

Numerous carbon and refractory material products are exhibited on this company's stand. Several crucibles, &c., are shown, including a crucible-type electric furnace capable of dealing with a 20-lb. charge of brass. There are carbon brushes of various types, turbine gland rings, magneto carbons, &c. The "Morganite" resistor, the applications of which were described at some length in a recent issue (June 13th, p. 958) is shown publicly for the first time. It will be remembered that this resistor is composed of a graphitic element embedded in a refractory material of such a nature that the coefficients of expansion of the two materials are about the same. The resistor can be employed for heating purposes, giving a low radiation from an extensive surface; in earthing or other resistances; in motor starters; and in annealing furnaces, drying ovens, &c.

The National Gas Engine Co., Ltd.

(*Stand No.* 93, *Avenue* 13, *Bays* 9 *and* 10.)

This company exhibits several examples of the smaller sizes of its internal-combustion engines. The principal one is illustrated in fig. 204. This is a three-cylinder vertical engine with a normal output of 150 b.h.p. It operates on the four-stroke cycle, and the reciprocating parts are totally enclosed, lubrication being effected by means of a pump supplying oil under pressure through the crankshaft to all bearings.

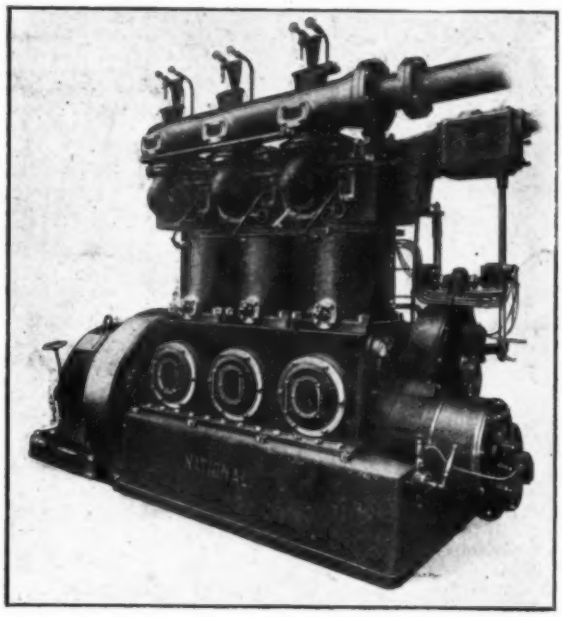


Fig. 204.—A 150-B.H.P. "National" Gas Engine and Generator.

The regular turning effort and good governing make this type of engine suitable for driving electric generators. The example shown is directly coupled to an English Electric generator. Engines of this design are made in a range of sizes of from 100 to 600 h.p.

Another exhibit is a 30-b.h.p. horizontal cold-starting crude-oil engine. The lowest-grade fuel oil can be employed and a special fuel pump and spraying device secure effective combustion at all loads.

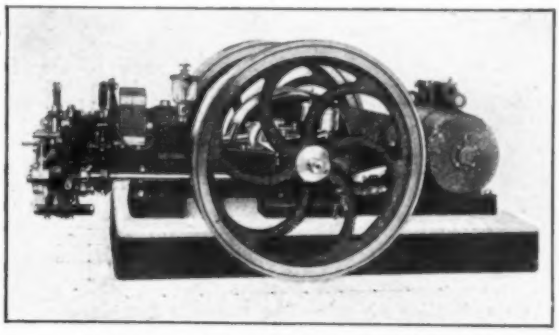


Fig. 205.—A "National" 3-kW Compact Lighting Set.

Fig. 205 illustrates a compact lighting set (3-kW) which is another of the company's exhibits. This consists of a horizontal engine, which will run on town's gas, petrol, or paraffin, driving an electrical generator by means of a totally-enclosed silent inverted-tooth chain running on machine cut chain wheels. Similar sets are made for outputs up to 7 kW.

The firm also shows a 6/7-b.h.p. vertical engine, arranged to run on the same range of fuels as the last engine, directly coupled to a generator. The engine is easily started up, has a low fuel consumption, is reliable, and specially adapted for country-house lighting or agricultural work. A compressor set for use in starting up large gas engines is also exhibited.

The Work of the Electricity Commissioners.

ANNUAL REPORT.

(*Continued from page 427.*)

Reorganisation of Electricity Supply.

When commenting in their first annual report upon the duties laid upon them in connection with the reorganisation of electricity supply, the Commissioners expressed the view that a great improvement was not likely to be realised as rapidly as was anticipated when the Electric Power Supply Committee made its report in 1918. During the first two years after the passing of the Act of 1919, all new schemes of engineering development suffered in consequence of the high cost of plant and the high rate of interest on new capital. The fall which has taken place during the past two years has improved the prospects of new schemes involving the displacement or non-extension of existing plant, but the changed economic conditions occasioned by the war still militate to some extent against the abandonment of moderately efficient plant in favour of supplies from large modern generating stations.

Engineering Aspects.

The maximum economies and most efficient service throughout a wide area can only be achieved when the generation of electricity for that area has become concentrated in a comparatively small number of modern, well-placed, and electrically interconnected stations from which the needs of all portions of the area within an economical radius of transmission can be met by means of bulk supplies. Under the *régime* contemplated by the Act of 1919, the principal method whereby the centralisation of generation can be brought about in a large electricity district containing a number of authorised undertakers, is by the transfer of the appropriate generating stations and transmission lines to a Joint Electricity Authority. The Commissioners are of the view that it is only by the establishment of a central body, such as a Joint Electricity Authority, endowed with adequate executive and financial powers, that a comprehensive scheme of development for a large electricity district can be carried out.

The process of reorganisation has been materially influenced up to the present by the pronounced desire on the part of the majority of authorised undertakers to retain the ownership and control of their generating stations, and by a disinclination to entertain the idea of transferring their generating stations to a Joint Electricity Authority; moreover, there has been a marked desire on the part of many undertakers to be allowed to continue to develop independently as under the former *régime*, and to extend their generating stations up to the limit of the capacity of the sites, whether well adapted or not for modern methods of generation, in preference to taking bulk supplies. While acknowledgment is due of the assistance received from many of the local engineers in the preparation of schemes, it cannot be said that the engineering schemes hitherto submitted to the Commissioners have, as a rule, been characterised by boldness of conception; on the contrary, they have been marked by a tendency to wait upon events instead of anticipating them.

The stumbling block presented by the question of the transfer of generating stations, which, as matters stand, can only be effected by the agreement of those concerned, has doubtless been responsible for the preference shown in various parts of the country for schemes providing for the establishment of advisory bodies and not for joint electricity authorities. While such schemes premise a measure of co-operation between the parties concerned and a willingness to operate under the general *ægis* of the advisory body, they necessarily leave the development of generation and main transmission to individual undertakers as hitherto. Such schemes undoubtedly represent an improvement in the organisation hitherto prevailing in the districts concerned, but it is clear that they fall short of the objects contemplated by the legislation of 1919.

In districts where the development of supply proceeds under the general supervision of an advisory body without executive powers, the most that can be attempted in regard to the unification of generating resources for the common good is to provide for a co-operative scheme of control over the working of the interconnected stations forming the principal sources of supply in the district. The effectiveness of advisory bodies and the extent of the economies and improvements which can be brought about under schemes of the kind in question must depend upon how far the constituent authorities can be influenced (i) to place the general interest of the district in the forefront; (ii) to refrain from proceeding with individual developments which may appear to be of local advantage although militating against the ultimate interests of the approved technical scheme for the district as a whole; and (iii) to frame and participate in an adequate scheme of control of the interconnected stations of the individual undertakers.

Owing to the administrative and other difficulties which are inevitably associated with schemes based on the continuance of individual development, to the necessity for securing the full adherence of each owner to an adequate scheme of control of the interconnected stations, and to the extent to which possible economies can be rendered unattainable by individual abstentions from such a scheme, it appears to the Commissioners that control of the working of stations remaining in individual ownership offers far less prospect of economy than central ownership, and is less likely to succeed in bringing about an adequate improvement in the organisation for the supply of electricity in any district.

The large capital requirements for the development of existing undertakings, whether of local authorities or companies, have been readily forthcoming, and in the majority of cases on reasonable terms. Finance cannot therefore be regarded as having proved a serious obstacle to electrical development under the auspices of the existing organisations.

As matters now stand, improvements in large electricity districts where substantial undertakings have already been established, by local authorities and companies alike, can only proceed by way of individual development unless and until such time as comprehensive schemes of regional development can be rendered possible by the establishment of a joint electricity authority with the necessary executive and financial powers. Comprehensive schemes of the character in question necessarily involve the incurring of capital expenditure in advance of requirements, whether on the construction of new stations or the laying of new transmission lines, and under existing legislation the financing of any such schemes undertaken by a joint authority must be mainly dependent upon the support of the various undertakers in the district concerned. Even where adherence is secured to a scheme of reorganisation involving the establishment of a joint authority, the financial lever remains in the hands of the constituent bodies in the district, and it is only by their co-operation and willingness to give adequate financial support that the functioning of the machinery of reorganisation can be ensured.

Among the administrative difficulties experienced by the Commissioners, reference may be made to those arising from inter-muncipal relations, from the somewhat novel questions attending the co-operation of municipal and company undertakers on joint bodies of the kind contemplated by the Act of 1919, and from the position of power companies whose statutory areas and powers extend over large parts of nearly all the electricity districts hitherto delimited by the Commissioners.

While in some parts of the country the Commissioners have noted with satisfaction a readiness on the part of municipalities to combine among themselves and also to co-operate in some measure with companies for the mutual advantage of all parties, in other districts, mistrust and political feeling have militated against such co-operation. It has been the consistent effort of the Commissioners to remove such difficulties and to induce a spirit of goodwill.

The task of settling the constitution of electricity district authorities has proved comparatively simple, and it appears to the Commissioners that the procedure governing the passing into law of schemes of reorganisation has, on the whole, worked satisfactorily. On the other hand, the legal difficulties with which they have been confronted have been numerous, opponents, and even friendly critics, having raised doubts or contentions in many cases as to the powers of the Commissioners in regard to provisions proposed to be included. The Commissioners, in certain instances, have reluctantly modified provisions in their draft Orders to avoid the necessity for an appeal to the Courts while not admitting that the scheme in its original form was *ultra vires*. The question of the possible removal of such of the legal difficulties as have been found to impede progress with reorganisation is under their consideration.

Since the passing of the Act of 1919, the Commissioners have delimited 15 electricity districts, 13 in England and Wales, and two in Scotland. In the case of one district where special considerations arise, no scheme has yet been submitted to the Commissioners, and in two other cases the Commissioners, after local inquiries, decided not to proceed further for the time being with the schemes originally submitted to them. As regards the remaining districts, schemes of reorganisation have been provisionally or finally approved by the Commissioners after local inquiries in 11 cases. Although several of the schemes were in their penultimate stages before the Commissioners at March 31st, 1924, final schemes approved by Parliament had come into force at that date in respect of four districts only.* Full particulars, and three maps, appear in the report.

While some measure of improvement has been effected by co-operative action under the schemes now in operation, the Commissioners cannot but recognise that there has so far been no fusion of interests in the generation and transmission of electricity, and that they have found themselves unable

* South-East Lancashire, South-West Midlands, North Wales and South Cheshire, and Mid-Lancashire.

to secure a thorough reorganisation of the supply of electricity in any district on the lines contemplated by the Act of 1919. There is a general tendency to submit schemes attempting to reconcile reorganisation with the practically undisturbed operation of established undertakings, and it is clear to the Commissioners that adequate reorganisation cannot be attained on the basis of present legislation so long as there persists a disposition to regard electrical development from a purely local standpoint.

That very large economies in the cost of generating electricity in this country can be effected by reorganisation on adequate lines has been fully demonstrated in the course of evidence given before the Commissioners. Moreover, it is the common experience that cheapened production on a large scale is a powerful stimulus to a wider demand, and there is scope for a manifold increase in the *per capita* consumption before any question can arise as to the "saturation" limit having been reached.

It cannot be too strongly stated that united effort and a willingness to pool resources for the common good are essential to produce the larger results of cheapening the supply throughout electricity districts and bringing about a great extension of public supplies for all purposes. The powers of control vested in the Commissioners by the General Acts have enabled progress to be made in securing co-ordinated development during the past four years, but it has become apparent that a real reorganisation, which will adequately serve the requirements of the country, can only be achieved on the voluntary basis of the Act of 1919 by a radical change in the attitude of authorised undertakers in general, and that, failing the early disappearance of the obstacles which have hitherto retarded progress, the whole position will call for review.

Generating Stations and Main Transmission Lines.

The aggregate plant capacity of the new stations and extensions sanctioned by the Commissioners during the year 1923-24 amounted to approximately 476,000 kW, as compared with the previous year's figure of approximately 422,000 kW. The total sanctioned from January, 1920, to March 31st, 1924, is 1,780,329 kW.

Of the plant sanctioned during the past year, about 11 per cent. was for new stations and 89 per cent. for the purpose of extending existing stations. The division of the total as between the various authorities was approximately as follows:—Local authority undertakers 70 per cent.; company undertakers 25 per cent.; and railway and tramway authorities and non-statutory undertakings 5 per cent.

At the beginning of 1920, the total capacity of the generating plant installed in the stations of *authorised undertakers* in Great Britain was approximately 2,309,500 kW. By the beginning of 1923 some 180,000 kW of obsolete or inefficient plant had been scrapped or superseded, the additional plant then installed, however, bringing the total net capacity to approximately 3,083,000 kW. When the whole of the plant sanctioned by the Commissioners up to March 31st, 1924, has been installed, the total capacity of the plant in the stations of authorised undertakers will amount to about 4,417,000 kW, less some deduction in respect of plant to be superseded. These figures are inclusive of new stations and plant extensions which were put in hand between the termination of the war and the enactment of the Act of 1919.

The consents issued by the Commissioners since 1920 have authorised the installation of as many as 78 sets having normal ratings of 10,000 kW or over, in eight cases the normal ratings being 20,000 kW or over. The aggregate capacity of the 78 sets in question exceeds 1,000,000 kW. At the beginning of 1920, approximately 50 turbo-alternators, each having a normal rating of 10,000 kW or over were installed or in process of being installed in the stations of authorised undertakers and in certain railway and tramway stations of which records are available to the Commissioners, the aggregate capacity of such units amounting to approximately 683,000 kW.

During the year the Commissioners issued consents to 10 authorised undertakers and to 16 non-statutory undertakings in respect of the establishment of new generating stations. In four cases the existing stations were not well adapted for further extension, and the provision of new generating stations had become necessary to meet the growing demand and to enable important local developments to be undertaken. The cases in question are set out below:—

Carlisle Corporation.—A new station at Willow Holme, to contain 11,000 kW of generating plant.

Hastings Corporation.—A new station at Broomgrove, to contain 9,500 kW.

Norwich Corporation.—A new station at Thorpe Hamlet, to contain initially 15,000 kW.

Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board.—A new station at Hartshead to contain 15,000 kW of 40-cycle generating plant. The practicability of changing the frequency in the area to the standard frequency of 50 cycles per second had been investigated in connection with the scheme of reorganisation for the South-East Lancashire Electricity District. Provision was eventually made in the District Order for the continuation of the 40-cycle system in the Stalybridge area and for the erection of a new generating station by the Stalybridge Board, as and when required, subject to the consent of the Commissioners.

New Generating Stations and Extensions.

With regard to the more important new stations in course of erection, the Commissioners state that the Agecroft station (Salford Corporation) is approaching completion, and will be ready for operation in December or January next. Barking station (County of London E.S. Co., Ltd.) is also well advanced; the capital commitments of the company approved by the Commissioners in this connection including transmission mains, amounted to about £2,105,000 in March last. Barton station (Manchester Corporation) was opened on October 11th, 1923, and is practically complete. Freemans Meadow station (Leicester Corporation), the first section of which was put into use in December, 1922, has made good progress with the second section. North Wilford station (Nottingham Corporation), Ribble station (Preston Corporation), and Stourport station (Shropshire, Worcestershire, and Staffordshire E.P. Co.) are in a less forward condition, but making satisfactory progress.

Important extensions were under way during the year, and additional plant of 423,000 kW was sanctioned; special mention is made of consents granted to the corporations of Bradford, Halifax, and Leeds in connection with the West Riding Electricity District; Birmingham in connection with the South-West Midlands Electricity District; the Charing Cross, Central Electric, City of London, and Metropolitan Companies and the Croydon and Fulham Corporations in connection with the London and Home Counties Electricity District; Lancashire Electric Power Co. and South Lancashire Tramways Co. in connection with the South-East Lancashire Electricity District; Liverpool Corporation; London County Council; South Wales E.P.D. Co. and Swansea Corporation, in connection with the South Wales Electricity District.; and Sunderland Corporation.

Reference is made to the action of the Corporation of Ealing in replacing obsolete plant with plant occupying less space but having a larger output, without the consent of the Commissioners; the High Court decided that the Act of 1919 covered extension of the plant's capacity, and that the cost of a new generating set was properly chargeable to capital instead of to revenue.

Main Transmission Lines.

Applications relating to the establishment of main transmission lines were granted in 27 cases; 16 of these were for 33,000-V lines, one for 49,500 V, and one for 66,000 V (Newcastle-upon-Tyne Electric Supply Co., Ltd.).

Special Orders.

At the beginning of the period covered by the report, 59 applications for Special Orders were under consideration, and 81 were received during the year. Orders were made in 59 cases, four were refused, and four withdrawn, leaving 73 under consideration. Twenty-six of the new applications were for extension of area, and 54 for the establishment of new distribution undertakings; in 18 cases competition entered. Eleven inquiries relating to 19 applications were held by the Commissioners.

Sanction to Borrowing by Local Authority Undertakers.

At March 31st, 1923, 123 applications from local authorities for sanction to borrowing for electricity purposes were under consideration, and during the year 542 were received. Sanctions were issued in 547 cases, five applications were refused, and 12 applications were withdrawn, postponed or transferred to other Departments, thus leaving 101 applications under consideration at March 31st, 1924.

The total amount of the loans sanctioned during the year was £9,776,593, as compared with £7,923,656 during the previous year. The amount for which sanction to borrowing was sought by the applications still under consideration at March 31st, 1924, represented in aggregate about £6,150,000. There was an increase of about 62 per cent. in the number of individual sanctions issued as compared with the previous year. While the average amount authorised per sanction issued was lower, the total amount of the loans sanctioned represented an increase of about 23 per cent. on the amount for the preceding year.

(*To be continued.*)

Electricity Supply Workers' Wages.

(*Concluded from page* 451.)

AT the final sitting of the Tribunal on September 15th, it was explained to the Chairman that the 12½ per cent. was consolidated in wages except in the No. 1 area. The reduction from 53 to 47 hours a week occurred on January 1st, 1919, and the hourly rate was increased so that the weekly wage was no less.

The CHAIRMAN then asked for information regarding the labour clause in contracts.

Alderman WALKER replied that in Manchester the large power contracts provided for an increase in the charge if there were an increase in the cost of labour of any amount. Thus any increase arising out of that inquiry would go on to the consumer. With regard to increased responsibility

with larger generating units, Alderman Walker said that where extra responsibility was involved, the men got higher pay. Mr. Taite had already stated that in the case of the Lancashire Power Co., 46 per cent. of the men were receiving more than schedule rates. Mr. Rowan disputed this. He said that the application did not cover merely the men engaged in particular stations, but it was made on account of the greater responsibility generally in the industry compared with that in other industries.

Mr. A. F. HARRISON, employers' secretary for No. 10 (London) area, said that a better standard could not be brought about by an increase in the hourly rates, although, perhaps, the better paid men of the electricity supply industry might be able to buy a little more than the poorer paid men in other industries. So far as the prosperity of the industry was concerned, the claim was really one to share in profits after all charges had been met, including the normal wages. Any such sharing of profits must be a matter of arrangement between individual employers and their employés and could not possibly be a national matter. No reason had ever been given for doubting the accuracy of the official cost of living figures as a guide and their accuracy had not been shaken. The average increase over pre-war wages in London was from 86 to 95 per cent. at the present time, whereas the present index figure of the cost of living was 71 per cent., so that the men in London had a large margin in their favour. He claimed that the present application was a contravention of the existing London agreement which was concluded so recently as 1923. If the 10s. now asked for were granted, it would mean that the London men would be receiving considerably more than 100 per cent. over their pre-war wages, whilst in the case of labourers the increase would be about 150 per cent.

Figures were then handed in showing that electricity supply workers of a particular grade were receiving considerably more now than workers in gas and water departments of municipalities in the London area.

Mr. HARRISON asked the Tribunal to ignore all the figures which Mr. Morton had put in for the men.

Mr. ROWAN suggested that the London supply companies were doing well. Mr. HARRISON replied that in the past these companies had lost large sums of money. For instance, the County of London Co. had had to reduce its capital by £250,000 some years ago before it started paying dividends.

Answering Alderman Walker, Mr. HARRISON said that with the reduction of hours, additional workmen had to be brought in. Mr. ROWAN, referring to Mr. Harrison's criticism of Mr. Morton's tables, said that he still contended that they were correct.

Alderman WALKER then summed up his case for the employers. He asked the Tribunal to rule out of consideration any reference in the application to the cost of living figures because there was an agreement on that point which the men had not given notice to terminate. Secondly, the demand was put forward as a national one, and must be so considered. Consequently, if it failed for any particular area—and he claimed that it had definitely failed for the No. 2 area for the reasons stated in evidence—then it failed altogether as a national claim. In the No. 2 area an industrial court definitely settled terms less than 18 months ago after a consideration of all the circumstances, and now the Union was asking the Tribunal to set aside that award without knowing anything of the circumstances of that area. Only one witness had been put forward by the men, and he only spoke for one area, and he had failed to bring forward one significant fact in favour of the application. As to competition, he took it from the chairman's ruling that the Tribunal was satisfied with the employers' evidence, and also with their evidence as to the disposal of surpluses, and he therefore would not say anything on those points. Dealing with the effect of the granting of the claim, Alderman WALKER said that in the case of Manchester it would mean an increase of 2d. in the £ on the rates, because no one dare suggest increasing the price of electricity at the present moment. The sum involved in the case of Manchester would be £41,600 a year. The claim was an endeavour to create a privileged class of workmen. Local rates of pay in industries must govern electricity supply men's wages, and the unions were the first to adopt this attitude when the electricity wages were lower than the others. He submitted that not only had the claim for a 10s. increase not been established, but rather that a case had been made out for a reduction, if such a thing were wished by the employers.

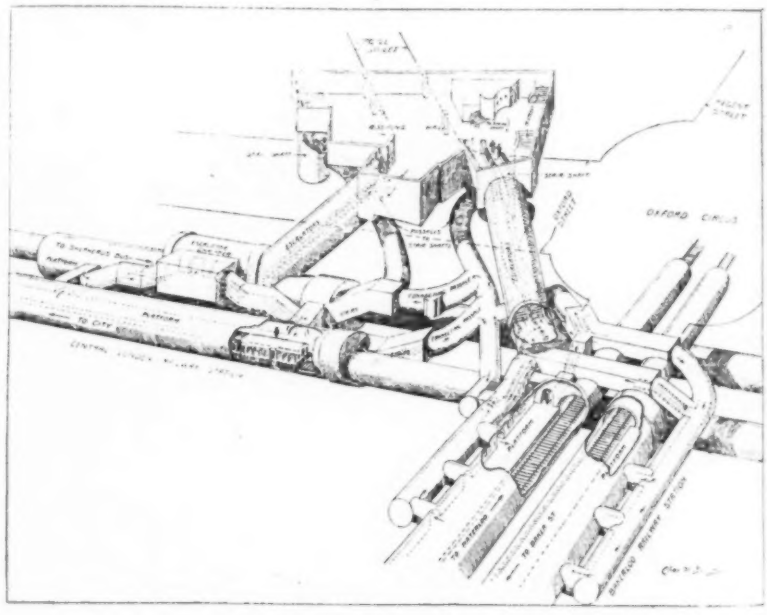
Mr. ROWAN, in the course of his final statement, said that it was playing with words for the employers to say that the profits shown in the accounts were merely surpluses and had to be applied to some other purpose than improving the conditions of the men. Such surpluses were as much for the improvement of the conditions of the men as for providing improved machinery. In support of his argument he quoted many figures from published returns of profits made by municipal and company undertakings, and again contended that they were profits in the ordinary meaning of the term. He claimed that the advance of 10s. per week could be made without putting anything on to the price of electricity except in isolated cases. Speaking of the comparative figures of wages in other industries put in by the employers, he complained that the building and printing trades, as two examples, had been left out, yet the men in these industries, employed on similar work to some of the grades in the electricity supply industry, were receiving higher rates. Nobody could say that the engineers in this country were receiving an adequate wage. It had been admitted by Sir Allan Smith at the recent conference that they were not, and the only reason why the employers did not grant an increase was because of the bad state of trade in engineering. If the employers' contention that local rates of wages must determine those paid in the electricity supply industry, then wages must be governed by the lowest-paid industries in the country.

Upon the conclusion of Mr. Rowan's speech the inquiry was closed.

The New Oxford Circus Station.

IN October last year the "Underground" authorities commenced the work of reconstructing the Oxford Circus station, which dealt with more than 36 million passengers during 1923, and they intend to open the new station in the early part of next year. One of the new features is an extensive booking hall which will serve for both the Central London and Bakerloo Railways. This is 130 ft. long and 60 ft. wide, and it is to be equipped with 10 "Passimeter" booking booths of the latest type and two additional escalators. A great deal of difficult and delicate work has been carried out during the reconstruction, for the region is one of very heavy overhead traffic. The face of the walls of the Central London and Bakerloo buildings below Argyle Street have had to be cut away and supporting girders and columns erected, while the ground beneath the intervening extremity of Argyll Street has had to be excavated and the carriage-way and footpaths supported by steel girders and troughs. The landing tunnel of the new escalators is superimposed directly upon the westbound running tunnel of the Central London Railway. The top of the latter tunnel had to be removed for a length of 36 ft. and replaced by 35 massive steel girders. The main escalator is 110 ft. long and 17 ft. in diameter; in excavating this a water-bearing stratum was encountered, and work had to proceed under compressed air.

The accompanying diagram shows in a striking manner the intricacy and extent of the work.



The New Oxford Circus Tube Station.

Vienna Strike Ended.—The Austrian metal workers' strike, which involved electricity supply and tramway employés, was settled on September 17th by a compromise between the workers and the employers.—*Reuter.*

The Institution of Public Lighting Engineers and Superintendents.

The Glasgow Conference.

THE first general meeting and conference of the Institution of Public Lighting Engineers and Superintendents took place in Glasgow from September 16th to 18th. On the opening day a welcome was extended by the Lord Provost, following which the presidential address of Mr. S. B. Langlands was presented. Mr. Langlands devoted his address to an account of the work of the Glasgow Corporation Lighting Department, remarking that Glasgow had more adequate general illumination in its miles of streets than many other cities. The total cost of the public lighting last year was £289,004, which meant that an assessment of 7.02d. in the £ had to be levied. In the city there were over 500 miles of streets and well over 20,000 closes and streets lighted each night. Electric lighting included 1,066 flame-arc lamps, 1,005 gasfilled lamps, and 1,543 metal-filament lamps. The main thoroughfares were chiefly lit by 8- or 10-amp. flame arcs. In the busiest thoroughfares they aimed at a maximum of 5 and a minimum of 0.1 foot-candles, an average of about 2 ft.-c. There were altogether about 1,200 employees of the department, which possessed workshops capable of dealing with repairs to lamps and laboratories and drawing offices where experiments could be made and plans drafted.

A paper by Mr. R. B. Mitchell on "Electric Street Lighting Mains in Glasgow," reviewed developments from 1893, when the first electric street lighting was introduced, to 1905. During that time additions to the scheme were frequent, but from 1905 to 1912 there was practically no further development. In 1912 the Glasgow Boundaries Act was passed and it brought the Burghs of Govan and Partick within the city area. By that time the flame arc was receiving attention and after 12 months' experimenting it was decided to change the whole of the arcs to flame arc magazine type lamps. Gears for raising and lowering lamps were also introduced and a great saving in labour was thus occasioned. During the war period 100- and 60-W metal-filament lamps were substituted, but after the armistice arc lighting was resumed, except in the Partick district, where 500-W gasfilled lamps were substituted. All new installations since 1919 had been equipped with 250-V gasfilled lamps in parallel circuits of from 5 to 7, the wiring being overhead.

In the earlier years pipes were laid in all streets where electric street lighting was thought likely to be introduced and vulcanised indiarubber cables were drawn in as required. This did not prove very satisfactory, as the alternate wetting and drying weakened the insulation and caused breakdown eventually. The same applied to bitumen sheathed cables and the author considered that where cables of this type were used they ought to be laid solid. The most satisfactory form of cable was found to be a rubber one with a sheathing of tinned copper; the sheathing, however, was delicate and great care must be exercised in drawing in, and especially in bending the cable. However, once installed, the cable had proved very durable. Twin lead-covered rubber cables laid solid had also given good results. Lead-covered cables with steel wire armouring lasted well if laid in suitable soils, but care must be taken where the ground had been made up. Overhead mains for street lighting were becoming the general method in Glasgow where at all possible; in Glasgow, with its extensive tramway routes, supports for such wires were readily available.

When tramway poles were used as lighting standards, with bases to house the connections, the continuous vibration of traffic was liable to open the doors and allow moisture to be admitted, causing leakages. Such faults as did occur in overhead wires were easy to locate and restore. In connection with faults in underground cables, the general test for location was Murray's loop test, which the author described. A number of the new housing areas in Glasgow had their streets lit by electricity and the method of planning such installations was described. Attention was drawn to the special Glasgow arc starter which enabled sets of street lamps to be automatically switched on in succession, an arrangement which steadied the electric current and helped to prevent flickering of the light of private consumers. Time switches were also used. The arc starter was very reliable, but it required a pilot-cable, which in some cases might prove costly. The time switches were adjusted to light and extinguish at certain times and were of the clockwork type. They had also proved very reliable, but did not allow for switching on at odd times in case of fogs, &c.; at such times operations must be carried out by hand. The number of miles of cable in use for street lighting was given as follows:—Underground 155 miles, control 30 miles, overhead 40 miles, housing areas, &c., 18¼ miles.

At the luncheon given by the Corporation at the City Chambers, Lord Provost Montgomery proposed the toast of the Institution, and in doing so suggested that the lighting of the city should be done so far as possible from the tramway standards, thus doing away with superfluous poles. He mentioned Mosspark as an example of a successful mode of lighting in which the use of posts was avoided.

Mr. Haydn T. Harrison's paper pointed out that street-lighting at present consisted of two portions, that provided by the public authorities, and that furnished by the motorists for their own convenience. In the case of fast-moving traffic, a minimum direct illumination of 0.1 ft.-c. was necessary, but road authorities to-day often provided less than 1/10th of that figure. The only possible way of raising the standard of lighting was to make better use of the luminous energy available. The plan proposed by Mr. Harrison involved concentration of light on the roadway; from the traffic standpoint people were not much interested in objects 10 ft. above the road surface and objects which it was required to render visible were confined within a vertical area of, say, 10 ft. high and 40 ft. wide, *i.e.*, only 4,000 sq. ft. By concentrating the light within such an area illumination serving the purposes of traffic could be efficiently provided. Mr. Harrison referred to his "longitudinal" system of lighting, some objection to which had been raised on the ground of glare. He had therefore devised a method of using three or more mirrors fixed above the lamp pointing in both directions. Thus six mirrors would ensure that from any position of the road four images of the source were visible, but gradually disappeared as one approached the post. Evidently on this basis the original intrinsic brightness of the source cannot be increased.

Finally the author also suggested a system of concentrating the light below the level of the eye, sources being equipped with a series of louvres which, with stationary light sources, would ensure that it never reached the eye-level. Highly concentrating projectors, each consuming 100 watts, could be mounted five to the mile. Such a system could be applied to country roads and others which would otherwise be unlighted on the ground of expense.

In the discussion the possibilities of such systems for important arterial roads constructed for motor traffic was pointed out. New roads of this kind now being planned would carry a far greater volume of traffic than the country roads of the past and some proper method of lighting was essential.

The final paper, by Mr. E. J. W. Stewart, dealt with "Street Lighting and Visibility." The author pointed out that methods of defining street lighting in terms of candle power, minimum horizontal illumination, &c., did not take into account the impression received by the eye, and might not meet the personal views of the public, which varied greatly. Revealing power was all important—not only persons and vehicles, but the route and the names of streets should be seen. Various modes of testing illumination were discussed, and also actual tests of visibility, *e.g.*, the recognition of obstacles of a certain size or shape placed on the roadway as adopted in some American tests. The choice of low small or high large units was next discussed. Some critics were disposed to consider that extreme uniformity of illumination was not needed; but most streets would be better for "levelling up" and contrasts between main and side street illumination should be avoided. Experiments had been made on avoiding glare, but the necessary measures usually involved additional expense and the approval of the public was somewhat uncertain.

At the business meeting office-bearers were appointed as follows:—President, Mr. S. B. Langlands; vice-president, Mr. R. Mason, Public Lighting Superintendent, Birmingham; honorary secretary, Captain W. J. Liberty, Corporation of the City of London; honorary treasurer, Mr. E. M. Severn, South Metropolitan Gas Company; honorary editor, Mr. E. J. Stewart, Glasgow.

The members of the Institution visited Edinburgh on September 18th, and were entertained by the Lord Provost and Magistrates. The delegates inspected the lighting methods in vogue in the city, and a visit was also paid to the new electricity station at Portobello.

Testing Fruit with X-Rays.—According to the *Morning Post*, the use of X-rays for detecting impurities and defects in agricultural produce is in course of being perfected by the Department of Agriculture of the Union of South Africa. Trials have shown that injuries caused to fruit by fruit-fly larvæ, which leave no external sign of injury, are revealed by X-ray examination.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The Mutochrome.

The Mutochrome is a scientific instrument for changing and transposing the colour combination in patterns and designs of every description. The picture of the pattern or design is *projected* in colour and may thus be seen by several persons at once. Each element of the design may be varied independently as to colour and brightness with remarkable rapidity. The instrument, which is marketed by the Chromoscope Co., Walmar House, 296, Regent Street, London, W.1, is the invention of Mr. C. F. Smith, of Messrs. Adam Hilger, Ltd., and consists essentially of a battery of lenses grouped closely together. First, it is employed as a camera to photograph (on one plate only, 8.5 by 6.5 in.) the different elements of the pattern or design the colour scheme of which it is desired to determine. Subsequently, when used as a projector, each lens will project its own image on to the screen and the elements will mesh and a realistic coloured picture of the design become visible in "life-size." Thus, in the case of a cretonne pattern made up of roses, leaves, and a background, one lens would project the roses, another the

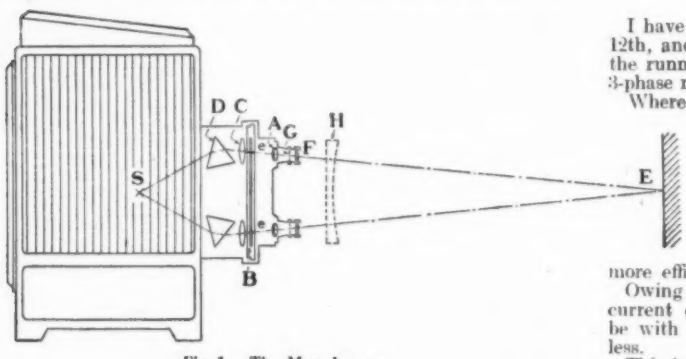


Fig. 1.—The Mutochrome.

leaves, and a third the background, the result being an absolute illusion of printed fabric. The design may be projected on to the material in which it is to be incorporated; thus, it is possible for the final appearance to be predicted with accuracy. No other apparatus is required in the preparation of the negative, nor is it necessary to move the instrument when once fixed in position relatively to the screen.

The optical system is illustrated diagrammatically in fig. 1. The lenses A (of any desired number) photograph and project the picture elements, and B is the photographic plate which is developed and used after the manner of a lantern slide. The light source S is a G.E.C. Osram gasfilled 1,500-watt "Projector" lamp, the light from which is diverged by the prisms D and converged by the condensers C. The iris diaphragms for controlling brightness are at G, and the colour filters at F; the height of the instrument is 1 ft. 8 in., its width 1 ft., and length 1 ft. 8 in. The drawing makes clear the reason why the picture elements mesh on the screen when projected. If E is a dot on the screen, the lenses A will, on photographing, form dot images at *e*. It is clear that if the relative position of the Mutochrome and screen is unchanged, the dots *e*, &c., will, on projection, be superposed on the screen.

The importance of the operation of the device will be understood at once by those interested in colour and design. An alteration in the brightness or hue of any one element in a multi-coloured design may serve to alter its balance entirely. To conduct experimental work for the determination of the best arrangement by existing methods is an expensive undertaking, and the preliminary stages in the development of designs for woven or printed material occupy so much time that designers adopt "rule of thumb" colour combinations, which they know by experience to be not unpleasing, rather than make experiments. Even if a completed design looks well on paper, it does not follow that it will look well when printed or woven into cloth. Textile manufacturers are well aware of these difficulties, and are occasionally put to great expense in experimental work.

The standard 10-picture Mutochrome enables 10 elements of a design to be independently varied at a distance of 3 ft. The size of the picture at this distance is approximately 18 in. square. If a larger picture is required, an additional lens (placed in position marked H on diagram) can be supplied.

The G.W.I. Plateless Valve.

A new type of radio receiving valve has been introduced by Messrs. G.W.I., Ltd., of Imperial Works, Shanklin Road, London, N.8. Instead of the usual metal cylinder, a silver deposit upon the inside of the glass bulb is used as the anode, totally enclosing the grid and filament, and thus utilising the whole of the electron emission. An obvious advantage of this construction is that the anode cannot vibrate, and thus microphonic noises are eliminated. It is claimed also that the tendency of the valve to "soften" is averted, prolonging the life of the valve, and the method of depositing the silver on the glass enables the gases to be removed at a lower temperature, without weakening the filament during the process of bombardment. The grid also has been modified in the direction of greater rigidity and freedom from vibration, and the cap is provided with a resilient seating, without the use of cement, so that the insulation of the terminal pins is improved and the valve is less subject to the effects of shock or vibration.

The G.W.I. valves are made in two types, one for use as a high-frequency amplifier and detector, and the other specially for l.f. amplification; both take 0.3 to 0.5-A at 4 to 6-V for the filaments, and 50 to 120-V for the anode.

Correspondence.

Correspondents should forward their communications* at the earliest possible moment.** ***No letter can be published unless we have the writer's name and address in our possession.

Three-phase Motors.

I have read Dr. Wall's article in the Review of September 12th, and I think all engineers who have had experience in the running of a.c. and d.c. motors will vote in favour of the 3-phase motor.

Where a variation in speed is required a d.c. motor is certainly the best type to adopt, but the majority of motors are required to run at a constant speed, and my experience proves to me that the 3-phase motor is far more reliable, and the running expenses much lower, than the d.c. motor. Where the load is not too great at starting, the squirrel-cage motor should always be used, as this type is cheaper, less liable to breakdown, and more efficient than the slip-ring motor.

Owing to the higher speeds adopted for large alternators, current can be generated far more cheaply than it would be with d.c. generators, and the capital expenditure is much less.

This is one of the reasons why power companies push a.c. in preference to d.c. current.

A 50-h.p. d.c. motor running continuously will probably cost £6 per annum in brushes alone, and on a large d.c. plant the expenditure on brushes will probably be far more than that on the maintenance of the whole plant.

More attention must be paid to a.c. motor bearings owing to the smaller clearance between the rotating and stationary parts of the machine.

Most manufacturers, however, now supply ball or roller bearings, and these are preferable to the oil-ring type.

In conclusion, I would say: Don't have too many types of motors in your works, as this means keeping a large stock of different sizes and makes of bearings, &c. Use 3-phase squirrel-cage motors with ball or roller bearings where the starting current will allow it. Avoid auto-transformer starters as far as possible, as these often burn out when the motors are started with unskilled labour. Use a good type of star-delta time-limit switch.

If the above suggestions are carried out the running expenses of the plant will be brought down to the lowest possible minimum.

Pelican.

September 17th, 1924.

With reference to an article in your issue of the 12th inst., under the heading of "The Place of the Three-Phase Induction Motor in Industry," by T. F. Wall, D.Sc., D.Eng., I note in the submission of data by the Allgemeine Elektriciaets-Gesellschaft, Berlin, that the increase in sale of d.c. motors as against 3-phase motors is qualified by the disinclination of old d.c. power plant owners to convert to 3-phase a.c. in view of the primary cost entailed.

This article offers me particular interest, having just returned from Canada, or, as it is very frequently referred to on the other side, "North America." There, I may say, electrical progress is hand in hand with America, and 3-phase induction motors are very extensively used (I might almost say exclusively used), and are performing satisfactorily the class of work in demand.

With reference to phase-changing, I have a detailed scheme of change-over from 2-phase to 3-phase, which has been tried and proved successful. The cost of the scheme is quite nominal in comparison with the advantage gained, as it is common knowledge that in copper saving alone 3-phase has an enormous advantage over 2-phase distribution.

The basis of the scheme is two "T" connected auto-transformers. The principle of the plan consists of interconnecting the two-phase bus bars with a pair of "T"-connected transformers.

I have no actual experience of the cost entailed by changing from d.c. to 3-phase a.c., and would welcome information from any reader possessing it.

In view of the present-day methods of phase changing, one cannot understand why 2-phase generation is allowed to obtain by any company working on business principles or as a business concern.

If any corporate body or supply company, considering the above-mentioned change of plant, would care to have fuller details of this scheme I shall be pleased to supply them.

I state this in the hope that it may be useful and interesting, and prove economical to some of our supply concerns which find the change-over cost prohibitive.

I would like to compliment and thank Dr. Wall for the article which I consider most interesting and useful, and also yourselves for publishing such interesting data.

Wakefield, **W. E. G. Watts.**

September 15th, 1924.

The Costing of Winding and Insulating Coils.

About three years ago I endeavoured to find out if there was a book on costing as applied to electrical manufactures. I did not discover one and, so far as I know, no such book has yet been published.

This fact makes the recent articles by Mr. F. C. Lawrence all the more welcome. These articles are by an authority who has evidently tested his findings in practice, and the publication of them in the ELECTRICAL REVIEW is an encouragement to manufacturers to look to this journal and to the Institute of Cost and Works Accountants for guidance on costing problems.

As one who has been confronted with similar problems, I was interested to read how, for instance, the author would deal with wedges, leatheroid strip, and the like items used in the manufacture of electric motors.

The costing of an electric motor is, apart from insulating material, a fairly simple proposition. You know how much was paid for the castings, for the coreplates, and for steel for the shaft; you know also what it cost to machine and assemble these parts. The same applies to the copper and to the labour cost of winding. All this is straightforward costing and, provided the overhead charge has been properly assessed, should not create any serious problem.

On the other hand, the cost of insulating material is, as Mr. Lawrence points out, usually allowed to slide into the overhead charge. This is bad from all points of view. The overhead charge should not be made the dumping ground for every kind of indirect expense; rather should it be subjected to the most careful analysis. Even so, the cost of insulating material need not be any part of it. The author's suggestion that the cost of "black tape, small pieces of cable, Empire cloth" and such details, should be distributed "in proportion to the weight of copper in the finished coils," will be a drastic enough change for many manufacturers, and I would suggest that, as an easy beginning, *all* insulation costs be allocated in this way. Later, the wedges, leatheroid, and any other material which lends itself to costing by standards of weight and labour times, might be dealt with as Mr. Lawrence has planned.

The great value of this series is that it covers the whole field of its subject from an authoritative standpoint. Mr. Clegg, F.W.C.A., did the same, in your journal, for costing as applied to the generation of electric power, and this idea, developed through all the branches of the electrical trade, would be of the greatest practical assistance to manufacturers who, anxious as they may be to know their costs, have only a hazy notion of how to start.

Frederick W. Pope.

Wakefield, *September 20th*, 1924.

Radio Transformer Characteristics.

The letter from a correspondent on the above subject in your issue of the 12th inst. contains a reference to the N.P.L. which is not in very good taste. The valuable work of this national institution is so well known and appreciated by members of the electrical industry that it is, fortunately, above the criticism of a private individual.

The voltage amplification curve referred to in the advertisement was published to enable those interested in the subject to see why the original transformer had achieved such remarkable success. No claims were made in the advertisement which have not been confirmed by the curve. While we have constructed intervalve transformers which give higher amplification at frequencies between 200 and 1,000, it should be explained that even a comparatively straight-line curve at the lower frequencies could not be guaranteed free from distortion, as under practical conditions the overtones and higher harmonics are just as important as the lower frequencies, and the former would then be more difficult to amplify to the same degree.

The design of the new transformer was adopted after conclusive experiments as the best general-purpose transformer to suit the majority of commercial valves. It functions with low and high anode voltages, and if used as shown in the diagrams supplied, will give pure reproduction free from distortion without exaggeration of the overtones. This has been proved beyond doubt by exhaustive tests carried out by many leading radio experts, including the technical staff of the ELECTRICAL REVIEW, and found to be an improvement on the original type, of which there are over a quarter of a million in use. This, surely, is the best proof of its efficiency, and we would recommend your correspondent to test it himself.

Radio Instruments, Ltd.
J. JOSEPH, *Managing Director.*

London, *September 16th*, 1924.

[The device was described in our issue of August 29th, pp. 319-20.—EDS. ELEC. REV.]

In looking over your issue of August 29th, page 319, I was amazed to notice, in a description of a low-frequency intervalve transformer which the makers claim as a "great advance" and "distortionless," that the curve of voltage-amplification against frequency varied from an amplification of 10 at 250 cycles per second to 32 at 2,000 cycles per second, which means that a note with a frequency of 250 would be amplified 10 times, while a note with a frequency of 2,000 would be amplified 30 times, or more than three times the amplification of the lower note. As the greater part of the audible frequencies are comprised in this range, the transformer would cause the most unpardonable distortion.

The curve referred to is verified by the National Physical Laboratory, and can therefore be taken as accurate.

It may be that the curve is published as a test for your readers' knowledge of wireless, but permit me to point out that it may do a great deal of harm among those who have not studied the subject—as, on seeing that the test is made by the National Physical Laboratory, they may think that this certifies the apparatus under test as being efficient, whereas this is far from being the case; the National Physical Laboratory will undertake to test and issue a "report" on anything from the capacity of a sieve to hold water to the most abstruse researches in electrotechnology, and such a "report" must not be confused with the certificate which is only issued in the case of apparatus for which definite standards of performance have been established, and which come fully up to those standards.

As a guide in judging an intervalve transformer, by its amplification frequency curve, it may be stated that the more nearly the curve approximates to a straight horizontal line, the better will the transformer be as regards freedom from distortion.

H. Coleman.

Dublin, *September 15th*, 1924.

Consulting Engineers' Specifications.

Your editorial on the specification issued by the consulting engineers acting for the Birmingham Education Committee puts one side of the matter very forcibly, but there is another side for which a great deal might be said with equal force.

Twenty years ago I shared your views, but "experience does it," and "never no more" will I issue a specification leaving the tenderer a free hand to offer the cheapest rubbish he can find (even though it be British rubbish) with the result that the lowest tender is one which cannot be accepted.

Apart from familiar allusions to "5 per cent. on the contract sum," every consultant knows how difficult it is to persuade a client to accept any but the lowest tender, and how impossible it is to convince the lowest tenderer that he is not being dealt with unjustly.

I believe it to be the consultant's duty to keep himself informed as to the best makes of apparatus and accessories, and to give his client the advantage of his experience by specifying makes which he knows to be satisfactory.

A method of specification which is not open to the devastating criticism of your editorial is that which gives the name of a maker whose products the consultant would be prepared to accept, followed by the non-restrictive words, "or other approved." For instance, the specification might read:—

"All alcoholic liquors shall be of Messrs. Moët et Chandon's or other approved make."

The tenderer might then put forward the products of G. H. Mumm or the Veuve Clicquot, and would have no excuse for offering aerated methylated spirts.

This method is fair to all: The consultant is introduced to two good makers of whom he may not have heard previously; while the tenderer of good standing knows that he will not have to lower his standard to get the job.

The client thus obtains the benefit of the experience of both consultant and tenderer: good products are encouraged, and "everything is for the best in this best of all possible worlds."

Boyd Dawson.

Westminster, *September 15th*, 1924.

[To our correspondent's second method of specification there is little objection, provided that the engineer does not disapprove of all "makers of whom he may not have heard previously." In this case the engineer uses a maker's name to define a standard of quality, and does not exclude products which are up to that standard, but of another make. In the abstract, such an expedient should not be necessary, as the standard aimed at can be defined without reference to any particular maker (at any rate, in electrical work); but we recognise that consulting engineers have to take human nature into account.—EDS., ELEC. REV.]

Electricity v. Gas.

I have just returned from holiday, and note that I am indebted to "A.M.I.E.E." for very kindly pointing out an error in my letter in your issue of August 29th. It is an obvious error, and, one would have thought, too apparent to deceive anyone.

Will those interested therefore please correct my letter of the 29th ultimo so as to read "Gas—3,018 B.th.u. from 1 lb. of coal"; the figure 5,800 for this item was inadvertently introduced, and is, as a matter of fact, a figure which I carry in my mind, relating to the value of the gas, but not from 1 lb. of coal.

I am aware that "A.M.I.E.E.," and possible others, may at once discover that these figures, even after correcting the gas production for 1 lb. of coal as above, do not square with my previous figure of 82 per cent. for the overall thermal efficiency of the gasworks process, nor with the 52 per cent. given for the thermal efficiency of gas production. I agree, but there is a great deal more in it than appears on the surface, and I hope to return to the whole question in the course of a few weeks through your columns.

I am interested to note in the Report of the Electricity Commissioners for the year ended March 31st, 1924, that at the Barton Station of the Manchester Corporation a thermal efficiency of 20.33 per cent. has been obtained. This is considerably better than anything that has come to my knowledge before. It is true that this is not an efficiency which generally obtains, as the second and third in order of merit show efficiencies of 17.6 per cent. and 17.47 per cent. At the same time, it shows that an efficiency of 20 per cent. is within practical reach. I refer to this in acknowledgment of "A.M.I.E.E.'s" figure of 20 per cent., which I doubted as being a regular figure obtained generally throughout the country.

J. R. Bradshaw.
(Engineer and Manager.)

Corporation Gas and Water Works,
Retford, *September 17th*, 1924.

Lightning and Radio Receivers.

In connection with the interesting article under the heading "Lightning and Radio Receivers," which appeared in your issue of September 19th, it may be of interest to Mr. Killingworth Hedges to be informed of a protective device now on the market which embodies all the points stressed by him, *viz.*, an outdoor appliance which provides a straight path to earth for lightning without entering the house. This path is obtained by a specially designed spark-gap affording negligible capacity, and ample protection is given against inclement weather.

R. B. Waterson.
S. F. Accessories Co.

London, *September 20th*, 1924.

Electricity Used Dangerously.

With reference to your editorial comments upon precautions in bathrooms and damp situations, and in particular to I.E.E. Rule No. 100, many inquiries reach us as to the interpretation of this rule in relation to geysers and local storage water heaters.

There is comparatively no difficulty in fixing the control switch out of reach of a person standing in the bath, but most forms of geysers or local water storage heaters must of necessity be fixed immediately adjacent to or over the bath or sink. It follows that the metal work of such heaters is necessarily well earthed because of their permanent feed-water metal pipe connection.

There can be no more danger (if any) with bath water heaters fixed on the bath or at any distance away, provided the *live insulated terminals or connections are not get-at-able to the user.*

George Nobbs, Ltd.
C. GEO. NOBBS,
Governing Director.

London, *September 22nd*, 1924.

[There is a doubt whether the metal work is *necessarily* well earthed; some water supply authorities require all boilers, including geysers, to be fed from a cistern.—EDS. ELEC. REV.]

Industrial Welfare Conference.—On Monday last week, at Balliol College, Oxford, Prof. F. Tillyard, of Birmingham, addressed the Industrial Welfare Society on the subject of "The Factory Bill and Welfare Work." The speaker explained that the Factory Act of 1901 was a complicated consolidating statute, very difficult to the lay mind, and went on to discuss the new Bill. According to his own experience, dealing with some 4,000 claims per annum in connection with unemployment benefits, many of which involved questions relating to working conditions, it appeared that many of the requirements of the Factory Act were inoperative; if the provisions of the new Bill were enforced, enormous changes would take place, especially in small workshops.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1923.

8,122. "Method of and apparatus for translating wireless and other telegraphic messages." Creed & Co., Ltd., and F. G. Creed. March 21st, 1923. (220,971.)

8,914. "Operating variable condensers or coils and the like employed for wireless telegraphy." R. V. Rawnsley. March 29th, 1923. (220,973.)

11,756. "Electrically-driven vehicles." J. Schurch and W. H. Heist. May 1st, 1923. (220,980.)

13,086. "Illuminated display for advertising and other purposes." A. E. Davis. May 16th, 1923. (Cognate application, 1,256/24.) (220,982.)

13,405. "Electric conduits and fittings therefor." Simplex Conduits, Ltd., and H. F. McLoughlin. May 22nd, 1923. (220,983.)

13,853. "X-ray tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. December 6th, 1922. (208,108.)

13,882. "Light-operated controllers." W. J. Curtis (Executor of E. H. Meden, deceased). May 25th, 1922. (198,370.)

14,081. "Telephonic receivers." E. A. Graham. May 28th, 1923. (220,988.)

14,231. "Electric switches." A. Reyrolle & Co., Ltd., and R. C. Minton. May 30th, 1923. (220,994.)

14,299. "Interrupters especially suitable for use in wireless telegraphy." W. F. Bubb. May 30th, 1923. (220,996.)

14,429. "Electric motor controllers." L. E. Wood. June 1st, 1923. (221,004.)

14,560. "Electric sub-station systems." T. W. Ross, A. F. Thompson, and Metropolitan-Vickers Electrical Co., Ltd. June 2nd, 1923. (221,012.)

14,561. "Vacuum electric tubes, devices and like evacuated apparatus." E. A. Ollard, E. Y. Robinson, and Metropolitan-Vickers Electrical Co., Ltd. June 2nd, 1923. (221,013.)

14,884. "Electric fuseboards and the like." Holmes & James, Ltd., and H. E. Sutherland. June 6th, 1923. (221,018.)

15,719. "Wireless receiving apparatus." S. Williamson and A. J. Williamson. June 16th, 1923. (221,027.)

15,811. "Tramway and like vehicles." W. J. Jones. June 18th, 1923. (221,028.)

16,227. "Induction motors." H. Green. June 22nd, 1923. (221,034.)

16,362. "Electric switches." J. Backus. June 23rd, 1923. (Cognate application 28,946/23.) (221,036.)

17,370. "Electrical installation for the operation of a movable body from a distance." N. Japolsky, M. Kostenko, B. Woronoff, and C. Sabaneew. July 4th, 1923. (221,041.)

17,990. "Secondaryy cells for portable electric lamps for mining and other purposes." I. S. Mackenzie, A. Abell, and Davis & Sons (Derby), Ltd., J. July 11th, 1923. (221,046.)

18,665. "Fluorescent screens for X-rays." Dr. L. Lilienfeld and Dr. R. Jahoda. July 29th, 1922 (201,549.)

18,855. "Coarse and fine adjustments for wireless or other instruments." C. W. Clarabut. July 23rd, 1923. (221,053.)

19,029. "Electric fuseboards or casings and the manufacture thereof." Holmes & James, Ltd., and H. E. Sutherland. July 24th, 1923. (221,055.)

19,030. "Hinges or articulating connections suitable for the casings of electric fuses, but applicable for other purposes." Holmes & James, Ltd., and H. E. Sutherland. July 24th, 1923. (221,056.)

19,405. "Electrically-heated kettles and like utensils." British Electric Transformer Co., Ltd., and E. Ellwood. July 28th, 1923. (221,059.)

19,499. "Glow cathode rectifiers." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. July 31st, 1922. (201,576.)

19,578. "Direct-current electric motors." H. Cooch. July 31st, 1923. (221,061.)

19,620. "Electric horns." W. J. Gooderidge. July 31st, 1923. (221,062.)

19,685. "Apparatus for controlling electric motors, particularly for use in conjunction with cable haulage." W. L. Hamilton. August 1st, 1923. (221,063.)

20,183. "Boxes for electric cables or the like." J. Guilfoyle. August 8th, 1923. (221,070.)

21,275. "Electric meters." Metropolitan-Vickers Electrical Co., Ltd. September 2nd, 1922. (203,322.)

21,632. "Method of and means for taking graphs of electrical variables." W. O. A. W. Baggally. August 27th, 1923. (221,077.)

25,279. "Apparatus for the electrolysis of water." Dr. L. Casale. October 10th, 1923. (221,102.)

27,168. "Crystal detectors used in wireless telephony and telegraphy." G. T. Rowell. October 30th, 1923. (221,110.)

31,672. "Variable electric resistance." B. F. Shortt. December 18th, 1923. (221,133.)

1924.

877. "Electro-dynamic telephonic transmitter or receiver." Siemens and Halske Akt. Ges. January 12th, 1923. (209,761.)

3,724. "Insulating cap for insulators for overhead transmission lines." F. J. Clarke. February 13th, 1924. (221,150.)

4,823. "Spotlights." H. E. Vandervoer. February 25th, 1924. (221,154.)

16,416. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., R. Mercer, and F. Tench. May 31st, 1923. (Divided application on 220,405.) (221,175.)

Moulding Sands Research.—The Council of the British Cast Iron Research Association has appointed Mr. J. G. A. Skerl, M.Sc., to take charge of an important investigation on moulding sands. Mr. Skerl has been for nearly three years research assistant to Professor P. G. H. Boswell, of the University of Liverpool, who has done so much work on moulding sands. The new work will be conducted in the Refractories Department of the University of Sheffield (Mr. W. J. Rees, F.I.C.), and in the foundries of members of the Association. The investigations contemplated are of such a character that the results may be made of immediate and practical utility to the ironfounding industry.

New Tramway Tower Wagon.—The Liverpool Corporation Tramways Department is constructing a new type of electric tower wagon, capable of running both on ordinary road surfaces and on the tramway track. This vehicle has been designed primarily for facilitating repairs to overhead equipment on enclosed tramway sleeper tracks, which are somewhat inaccessible to the ordinary type of tower wagon.